THE

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GERMAN INDUSTRY AND THE WAR.

MUCH attention has been given of late by our French Allies to the past and future relations between their industries and those of Germany, and an intense desire to free themselves from the fetters which their enemies have forged about them has been manifested. Every effort is to be made to enable France, by her own resources and those of her Allies, to become independent of imported German products, and if possible to exclude them altogether. To this end the Société d'Encouragement pour l'Industrie Nationale has organised a series of lectures by specialists upon the means to be adopted in the industrial war which will inevitably follow the military struggle, and seeing that we have to face a similar problem, the views expressed are of interest to ourselves. One of these lectures was delivered by M. Henri Hauser, professor of the University of Dijon, who demonstrated that the war was not due, as commonly held, solely to the ambition of the military party in Germany, but mainly to the excessive and too rapid development of German industry and commerce, which rendered war, if not a necessity, at any rate so tempting a proposition, even to financiers and business men, that it could not be resisted. Germany is by no means over-populated and in need of room for expansion, although she may have laboured under that hallucination; in point of fact, emigration from her shores fell from 200,000 a year in the eighties to a tenth of that number of late, while some three-quarters of a million of foreign workmen enter her bounds each year.

The evolution of German industry, which in 40 years has raised the Empire from commercial obscurity to the second place in the ranks of industrial nations, beaten only by Great Britain herself, is to M. Hauser a most remarkable phenomenon; it has been achieved not by spasmodic efforts, but by patient, tenacious, methodical labour, never relaxed. Germany possesses a genius for organisation, for utilising men and drawing from each the maximum output, and if she apparently has lost the talent for making great new discoveries, she is expert in the art of applying the discoveries of science to industry; her prosperity is due to the union of the laboratory and the workshop. The rapid rise of German industry deprived it of the long and slow preparation which characterised that of Great Britain, and had the gravest effects upon the internal economy of the country, foremost amongst which were the migration of the rural population to the towns, and the abrupt cessation of emigration to foreign shores. An agricultural state is independent and self-contained; but the industrial state which thus took the place of the agricultural had totally different wants, including imported food and raw materials, capital, and clients; thus it was no longer self-sufficient, and the "World-policy" was forced upon it, with its subsidies, cartels and external "dumping."

In addition to the open and above-board methods of pursuing this policy, M. Hauser describes how the German "tentacles" have laid hold of French industries, under disguise—and not only French, but also Russian, Turkish, Italian, Swiss; not only do they control the industries, but by holding the shares in the pseudo-native companies they convert the financial system into a veritable pump, sucking wealth in Italy or Switzerland, and discharging into Germany. They suborn the Press, and corrupt political life in the countries that they infest. Above all, Great Britain was the most prominent competitor with Germany, and it was necessary to bring about her downfall. By degrees the idea of a necessary, almost desirable, war grew upon the industrial classes, and the extent of its hold is proved by a study of German literature, from which a warning could have been derived had it been heeded, for years ago it plainly outlined the future trend of German policy and the inevitableness of war.

The Germans, in their dreams of the future, look forward to an industrial victory—to the triumph of the business man. That dream has proved illusory: "Time does not spare that which is made without it." But none the less, when vanquished by the Allies, Germany will patiently and obstinately resume her labours, and those who would not be crushed must *now* mobilise their forces for this new war.

In a note published in the *Bulletin* of the same Society, M. Henry Le Chatelier criticises the tendency of many industrials to take too narrow a view of the situation, limiting their proposals to the establishment of new tariffs, the extension of working hours, the demand for the banks to support French industries more effectively—all proposals which require no effort on their own part but involve increased cost to consumers. He also attacks the suggestion that scientists should be called upon to place their services at the disposal of industrials, pointing out that the former cannot dip into this or that subject at random, unless they either charge fees out of proportion to the services rendered, or accept a remuneration equally inadequate to compensate them for their work. The scientist is not an Admirable Crichton, able to pronounce a valuable opinion on every subject under the sun; his value lies in the *scientific method* on which he works, and the proper course is for the industrial to give continuous employment to engineers and chemists at adequate salaries. In Germany every works has its own laboratory. In addition to these private laboratories, there should be syndicated laboratories working for all the firms in a particular industry, to prevent waste of effort by overlapping and retraversing the same ground; and above all these should be the great State laboratories, such as our National Physical Laboratory, collaborating with the lesser ones. This system is largely responsible for the success of German industry. On the other hand, it entails the gradual disappearance of the small factories, and requires the possession of knowledge of laboratory practice on the part of the technical directors of works. The small works cannot afford the cost of maintaining a laboratory, or of the technical and commercial organisation which is indispensable to low cost of production, high quality of products, and an assured outlet for them.

Unless the technical director is familiar with laboratory practice, he will be incapable of utilising a laboratory to advantage; he will not know what problems to entrust to it, or how to define them, and his laboratory will be a white elephant. M. Chatelier deplores the exaggerated importance attached to mathematics and abstract science in France, whereas the urgent need is the study of the experimental sciences, upon which all industry is based; provision must be made to fill this want.

To meet the German competition it is useless to attempt to erect insuperable barriers; it is necessary to adopt their methods of working. The process involves a somersault of opinion on the part both of the Government and of the industrial world. Our Goverment has already executed that feat, and shows every indication of earnestness and sincerity in carrying out the new policy; but without the concurrence of our industrials the effort will be in vain.

It is useless to place fine tools in the hands of unskilled labourers, and that will be the effect of training young physicists and chemists for research work if they are to be subordinate to men who are incapable of utilising their abilities to the best advantage.

Lead.

Lead has had a sharp depreciation in prices since last writing, but the decline has probably proceeded about far enough, and there have been intervals, indeed, when the market has assumed a decidedly more healthy appearance. The wholly fictitious level of values, which has been brought about largely by excessive speculation both in America and on the London market, has been followed by the usual aftermath of liquidation, and the past fortnight or so has seen a thorough weeding out of the overbuilt fabric of "bull" commitments. There is no doubt that the original speculation in the United States, which put up the price of lead on this side momentarily to £30 a ton, was intimately connected with share considerations, and had little or nothing whatever to do with the position of the metal. The upward swing in America, of course, brought in a lot of rag-tag buying here, and this has been the source of trouble ever since, because those who bought lead as a speculation being, as is too often the case, unwilling to cut their loss, have held on, and disastrously. The existence of this unhealthy element in the situation was, of course, perfectly well known in the market, but it has by now been practically all eliminated, and to this extent the technical position is undoubtedly much better than it has been for quite a time. Considered from a purely statistical point of view, the price of lead should certainly be quite high enough, as will be seen from the following details, showing the United Kingdom imports of pig lead and sheet lead during recent months:—

From	July. 1914.	July. 1915.	Jan.-July. 1914.	Jan.-July. 1915.	
Spain	7,082	10,140	49,371	61,903	tons.
U.S.A.	2,846	1,760	13,296	38,877	„
Mexico	243	—	1,595	250	„
Australia ...	5,940	10,059	45,370	46,455	„
Other countries ...	1,653	1,961	18,226	11,158	„
Total ...	17,754	23,920	127,858	158,643	„

The excess of supplies this year over last, as will be seen, exceeds 30,000 tons, the most remarkable increase being in connection with the United States, which country has increased its contribution by about 200 per cent., while Spain is more than 25 per cent. up. There is practically no alteration in the amount coming forward from Australia, while in respect to other countries there is a falling-off. All accounts agree that the actual amount of business being done by the general consuming trade shows a very distinct reduction compared with the pre-war period. On the other hand, it must be remembered that the consumption of lead for munitions purposes is on a wholly unprecedented scale, and that huge requirements in this connection are inevitable until the war is actually over. Large demands for pig-lead continue to reach the London market from Russia, and considerable quantities of lead are being dispatched from here to our Northern Ally, the total shipments of English and foreign lead from British ports during last month being about 4,000 tons. Further permits for shipment continue to be issued, and this tends to wipe out the excess quantities of metal arriving here. Production has been greatly stimulated by the prevailing high range of prices, and when this point is given the prominence which is due to it, the tendency is rather to take a rather conservative view of price movements in the near future, though there are always, of course, speculative elements to be considered.

LAMP AND LIGHTING DEVELOPMENTS IN THE NEAR PAST AND FUTURE.

By L. CROUCH.

Artificial lighting is largely out of season just now, partly by reason of the long hours of daylight, but chiefly owing to the real and supposed military exigencies—to which one accedes, but not without mental reservation of many kinds concerning the necessity and *rationale* of certain regulations! Nevertheless, the present seems a more favourable opportunity than has existed for many years past for taking stock of the means of lighting at our disposal, and in particular for examining whether the lines along which lighting has been developing during recent years, are desirable and suitable for further pursuit when peace again reigns, and provision, rather than obliteration without extinction, of artificial lighting again becomes a practical problem. In resuming possession of home trade, and in extending our lamp and lighting activities abroad, it is very desirable that we should follow the best lines compatible with local conditions and demands. Both in lamps and fittings we are engaging on a good deal of new work, and at the time of taking this up, and during the temporary suspension in many more or less established lines of activity, there is an opportunity which will not recur to set our old furniture in order, and see that our new ventures are well started.

Devoting first a few words to the most obvious phase of present public lighting—its absence—there are some useful lessons which have been and may yet be learned from this. The circumstances of wholesale reduction of lighting were so urgent and unprecedented that no doubt the first means adopted were far from the best. When it became obvious that dim lighting would be required for a considerable period, numerous efforts were made to improve the results, while still conforming to the requirements of the authorities. Guided by experience gained from the first crude methods, a considerable measure of success was secured, showing that abnormal and temporary as the present conditions may be, they are capable of yielding permanently beneficial results. Taken all in all, the inconvenience of reduced lighting (as *now* reduced) is far less than could ever have been anticipated. Except in isolated cases there is little difficulty—at any rate in the writer's experience—in seeing kerbs, pedestrians and vehicular traffic, though he must confess to frequent anxiety as to whether the drivers of 'buses and taxis can pick him out before they run into him. In the more dimly lighted streets, instances of almost complete invisibility by a sort of natural protection or light-and-shade matching, are often to be observed. No doubt the Purkinje effect is frequently operative; for instance, it is often impossible to see the scarlet armlet of the National Guard.

Through all the dimming of street lamps the object in view—or which ought to have been in view—was to give as satisfactory traffic illumination as possible and as little light as possible directed upwards, whether directly or by reflection, diffusion and haze forming. Such an end is, broadly, desirable in peacetime as well as when unwelcome aerial visitors are expected, and it will be a great pity if advantage is not taken of the present opportunity to investigate completely the question of the best polar distribution for street lighting—particularly with regard to the use of new types of globes and reflectors. The public have become accustomed to a state of affairs very different to the hitherto accepted standard, and before reverting to the old and often crude system of street lighting, steps should certainly be taken to see if permanent good cannot be brought out of the present evil. It is not likely that ever again so good an opportunity will be found for conducting street lighting experiments on a large scale, and with variations from accustomed systems which could hardly be tested after the old order of things had been even temporarily restored. The result of improvements in this direction would naturally be more effective lighting at reduced cost.

At the other end of the scale to the street lighting now provided in our cities, lie the "White Ways" of America. Many of these are very fine in appearance, but others are literally glaring atrocities. Still, whether good or bad as judged by us, "White Ways" undoubtedly appeal to the American temperament, and effectively "boost" a street or town (again to Americans). To that extent they justify their existence, and by the same argument they are hardly likely to find favour in their most aggressive form in this country. Our own display lighting is relatively unobtrusive, the American style being generally reserved for fair grounds.

We might very well imitate America, however, in dealing with street lighting problems more lavishly. For instance, very large scale comparisons have been made in Chicago between half-watt tungsten and arc lamps for street lighting, and as a result of these tests it was decided to utilise the former as a standard in place of the latter, which were adopted two years ago, some 10,000 being in use. Imagine the amazed consternation (and uncompromising disapproval) with which the British anything-but-electrical Electricity Committee would receive such a suggestion! The Chicago tests were probably the most complete yet made as between half-watt and arc lamps, and it is interesting to note that they decided in favour of the newer lamp which has, of course, lower nominal efficiency than any arc lamp. The arcs to be replaced are 450-watt units, yielding 1,100-1,200 maximum C.P. at 30° below horizontal. This candle-power is subjected to 8 per cent. absorption loss by a new inner globe, and to nearly 50 per cent. loss after the globe has been in use for a time, owing to deposits and etching, which brushing will not remove. Even washing the globe restores only three-fourths the original efficiency, so that practically the same working illumination is obtained from 300-watt filament lamps giving 600 maximum C.P. and provided with prismatic, refracting globes to obtain improved lateral, long-distance distribution. Maintenance costs are estimated to be the same at present for arcs and half-watt lamps, and will be less for the latter when longer life than 1,000 hours can be guaranteed (actually, it is already often obtained). The first cost of the tungsten equipment is half that of the arcs.

Even more important than the elimination of former defects in public street lighting after the war is the proper control of privately-owned lamps and signs on the exterior of buildings. What is needed in the electric sign field in particular is fewer restrictions and more control. During recent years the restrictions in most cities in this country have practically prevented the development and use of really effective electric signs, but they utterly failed to suppress many which are an eyesore by day and a nuisance by night. In this respect, again, it must be admitted that the States are far ahead of us. Of electric signs as they are understood in the States, we have here no examples. Where our signs are not hopelessly prosaic, they generally suffer from one or more of the defects of unsuitable lighting, erection and operation. The average man will look longer and with more interest at a sign which is really artistic and interesting than at one which is simply a startling jump and glare. It is difficult to see any difference in principle between a badly-designed, placed and operated advertising sign and a man who shouts out of his window or commits other nuisance to attract attention. One of the most elementary measures which might be taken to improve matters is to insist upon architects making some provision for the harmonious accommodation of electric signs when designing buildings on which it is certain such will be used.

Whether the illumination of the exteriors of buildings as a whole is desirable, or would appeal to people in this country, is a very moot point, but in this as in their best electric signs, American engineers employ surprising amounts of energy and obtain very effective results. The illumination of the outside of the Woolworth building, for instance, absorbs 175 KW. (approximately the maximum station load in such towns as Grangemouth, Cromer, Berwick, Carnarvon, Dorking or Bray). Six hundred 250-watt nitrogen-tungsten lamp projectors are used, in addition to 24 1-KW. lamps in the tower. Some of the projectors shine upwards and some downwards along the face of the building, which is bathed in light without the source of the latter being obvious or in any way annoying. The *motif* of this scheme is, again, a matter of national temperament, but from the illuminating standpoint it is unquestionably a triumph. To descend to a much humbler but perhaps more utilitarian plane, similar methods might very well be adopted here in the illumination of poster hoardings. As

ordinary mortals we would gladly see every hoarding swept off the face of the earth, but as advertisers are hardly likely to agree to such a proposal, electrical manufacturers and central station engineers should take active measures to point out that a properly lighted hoarding is more effective and pleasing by night than by day. There is still room for much improvement in the means of lighting extensive vertical surfaces and in determining the most effective nature and amount of light. By using a number of differently coloured lights in turn (with an intermediate and longer exposure to white light), considerable attention could be attracted by the weird colour distortion produced; during the illumination by white light, the watcher "takes the medicine!"

Agreed as we all are on the desirability of low intrinsic brilliancy in luminous sources, it is curious that we seem ever to get further away from our ideal. The reason is, of course, that we employ almost exclusively lighting by *incandescence*, so that every improvement in efficiency depends on higher working temperature and increased intrinsic brilliancy. The effect of the latter is to increase the importance of fittings (reflectors, refractors and diffusers) which alone produce tolerable results from an intolerable source and distribute light which is generated economically but very locally, in an economical and suitable manner. The use of appropriate fittings is practically inevitable with all high efficiency lamps, and though this frequently involves considerable loss of efficiency in some directions, the fitting often does much to pay for its absorption losses by recovering and applying rays which would otherwise be wasted.

Though the view may be very heretical, the writer is strongly of the opinion that in many directions "scientific" precepts have been carried too far in illuminating work; too much importance being attached to the almighty foot-candle and the power expenditure necessary to provide it. Illuminating engineering itself is anything but an exact science, and there are so many variables and so many empirical factors concerned, that it is difficult to see that the "design" of illuminating schemes can ever be much more than the application of glorified "rule of thumb." It must be admitted, at least, that many of the rules and methods advanced encourage a false sense of security, and are apt to give very disappointing results when applied by "illuminating engineers" of limited experience and great faith.

Just as the managers of commercial and manufacturing undertakings are coming to realise that the total cost of lighting is a trivial fraction of their total operating expenses, whilst the extra cost of good as compared with bad lighting, is yet more negligible, so the ordinary householder is realising that the total cost of lighting is not a serious item if modern electric equipment be used, and that it is worth paying a few pence a week for a more pleasing effect with a little less efficiency. Those fittings which give the highest efficiency always look, somehow or other, as though they were doing it. There seems always an air of cold virtue and severity about them and their illumination, which contrasts unfavourably with the cheery and somewhat *mechant* air of fittings which are less particular about a few per cent. absorption and misdirection. The writer would not for a moment suggest that inefficiency is desirable *per se*, but simply that the most pleasing effects seem always to be obtained with equipment which is not of the highest possible efficiency, and there is no doubt that psychological effect is an increasingly important factor in determining the commercial success of lighting equipment.

It is no use telling or even proving to a man that a certain lighting scheme is the most economical available for his home. The argument may prevail outwardly, but if the "effect" of the lighting scheme is not right, that scheme is not, and never will be, satisfactory. Foot-candles and distribution may be perfect as judged by the most voluminous tables and formulæ in the illuminating engineers' pocket book, but if the room does not *look* right to plain Mr. Smith directly he enters, the probabilities are that it is *not* right. There are elements in illuminating engineering which cannot be expressed by figures and factors—prejudices, if you will—which cannot be overcome by "educating the public."

(*To be continued.*)

THE SELLING SIDE OF ELECTRICITY SUPPLY.—III.

The internal arrangement of showrooms offers scope for a great deal of ingenuity. In giving play to this, however, one must not lose sight of the demands of good salesmanship. Having through the effect inspired by the window display induced the prospective customer to walk in for a further inspection, everything must be done to turn that first curiosity into something more concrete; therefore no less attention and care is required inside than is bestowed on the front. Size and shape must determine the general lay-out. The ceilings and walls are naturally claimed by fittings. With regard to these, although their sale is not regarded as the main objective, it is usually an important branch of showroom business; properly equipped it will be a convenience to many contractors who are without extensive showrooms of their own. A sufficiently large turnover must be obtained therefore, to secure the over-riding or factors' discount that will enable you to sell to the trade; for the contractors who come to you will naturally expect the full discounts to which they are accustomed.

A great many shops are oblong in shape, and where this is the case it lends itself very well to breaking up, so as to display panels of fittings. One of this nature recently inspected had been arranged with a considerable amount of skill and taste. The ceiling had been divided into four sections by three rows of corona dining-room pendants. There were four of these in a row, at both ends of each row two 2-light bedroom counterweight fittings were fixed, and, closer still to each wall, two hall lanterns. They had thus a display of one dozen dining-room fittings, one dozen bedroom slide fittings, and a dozen lanterns, which showed up very well without any appearance of crowding. The spaces between the rows were filled with various cord and chain suspension fittings, mostly of the three and five-light variety. At the extreme ends were rows of single-light drop pendants. Coinciding with the spaces broken by the rows of dining-room pendants, the side walls were divided off into four panels on each side. These panels were fitted up with a large number of various types of brackets, several panels being reserved for period styles. Round the showroom three narrow benches were fitted forming three steps up from the floor. These were filled with appliances, radiators, etc., broken here and there by standard lamps. The general effect was excellent, the pretty coloured silk flounces of the dining-room pendants and the shades of the standard lamps making it quite a fairy-land, and no doubt many visitors were induced to look in on that account.

An ambitious showroom assistant should familiarise himself with the principal styles of architecture and interior decorations; a superficial knowledge at any rate should be acquired. By superficial, I mean something more than *Aristide Pujol's memoria technica* for the instant recognition, by the vulgar, of the three orders in architecture, "cabbages, Corinthian; horns, Ionic; anything else Doric."

He should have some acquaintance with the principal French, English, and Dutch period styles, which should extend to some detailed knowledge of the dainty work of Adams Bros., Chippendale's choice frets, Sheraton's chaste designs, etc. Many people are very undecided and helpless in selecting fittings and welcome the assistance of the salesman if he impresses them as a man of good taste. One is often asked to suggest a suitable fitting for a room furnished and decorated in some special style. Some help can be had by studying the catalogues of leading manufacturers, as sections will usually be found devoted to the subject. Care is required, however,

as frequently the classification is open to dispute, and some of the fittings have incorrect detail, giving bizarre effects.

Flemish and French, particularly Louis Seize candelabra, are very strong sellers, and are worthy of a good deal of space if the class of district in any way warrants it. A disadvantage (from the consumer's point of view) of candelabra is that considerably more current is required for illuminating a room than in the case of ordinary direct fittings. My experience of indirect and semi-indirect fittings is that these have not sold very well when mixed up with direct types. When shown in a room by themselves, however, they sold very well indeed, even with a display of only 40 pieces; the semi-indirect type appear to meet with the greatest favour.

There is a lot to be said for the semi-indirect fittings; from the station point of view the fact that about 50 per cent. more candle-power is required than with the direct style is a recommendation in these days of high-efficiency lamps. From the consumer's side they have the advantage that less wiring is required than for several bracket points, and one large lamp is cheaper to buy than several smaller lamps, and also much stronger. Then the well-balanced soft light, with a complete absence of eye-strain, alone provides a fund of argument for the fitting and for electric lighting.

ELECTRICITY SUPPLY IN MELBOURNE.

In the course of his presidential address to the Victorian Section of the Electrical Association of Australia, Mr. W. H. Alabaster compared the output of electric supply undertakings in Melbourne during the years 1904 and 1914. The number of units disposed of and the average price obtained for them during those years were summarised as follows:—

—	Units consumed.			Average price obtained (pence).		
	1904.	1914.	% increase.	1904.	1914.	% decrease.
Light	3,302,973	12,739,742	285·7	4·46	3·57	19·95
Power and heat	986,189	14,776,853	1,398·0	2·19	1·46	33·3
Public lighting	1,440,151	1,985,915	37·9	2·52	1·25	50·4
Traction ...	—	5,102,015	—	—	1·10	—
Bulk supply ...	—	1,395,251	—	—	1·49	—
Total	5,729,313	35,999,776	528·0	3·58	2·14	40·2
No. of consumers	2,256	29,316	1,200			

This comparison, he said, denoted substantial progress made in so short a period, but the possibilities ahead of them were still greater. Increased sale of current, provided that the increase did not adversely affect the existing load factor, had the effect of decreasing practically every item of expenditure, which made materially for lower selling rates.

The average price of electric light in Melbourne compared favourably with that obtaining in the old world. It was not until recently that sufficient inducement was held out to the large manufacturer to relinquish his existing motive power in favour of a supply from the power station. Suitable modifications of the tariffs had now been introduced, and it was certain that the consumption for this purpose would be greatly increased.

The average price obtained per unit for private lighting had decreased 20 per cent., and the increased efficiency of metal filament over carbon lamps might be taken at 200 per cent., so that for equal lighting the consumer now paid about 27 per cent. of what he paid in 1904. A half-watt lamp would, of course, greatly improve upon these figures; from what he had seen of these lamps, they had a very large future before them. Taking the average life of a 130-watt ordinary tungsten lamp as being 1,200 hours, the higher efficiency of the half-watt lamp would pay for its additional cost during a life of 450 hours when current was charged at 3½d. per unit.

The consumption of energy for power and heating purposes showed a wonderful advance during the period under review, and there was every indication of the rate of increase being not only maintained, but accelerated. The supply of energy for refrigerating purposes had been responsible for a considerable portion of the power load recently obtained, and this supply, with its load factor in the region of 100 per cent., was very welcome to the supply undertaking.

In the near future, units supplied for cooking and water heating would be in demand on every day in the year and at any time of the day or night. With a view to obtaining the fullest information, he had so equipped his kitchen that the whole of the cooking and water heating (except bath water) was being carried out electrically, and during the last 16 months he had tried various types of apparatus. The consumption of current during that time (including current used for ironing) had averaged 32.6 units per week for a household of three adults and one child. He was convinced that reliable apparatus was obtainable, and that faults were more likely due to the manner in which the apparatus was installed and to unsuitable flexible cords, etc. Meat or pastry cooked in an electric oven was infinitely preferable to that cooked in a gas oven. There was, however, room for improvement in the appliances designed for boiling, as the cost of vessels with self-contained elements did not permit of the same range of vessels generally associated with the gas ring, and hot plates at present were too slow. The latter difficulty would probably be shortly overcome either by the hot plate with oil-immersed element or by the radiant type of plate. One of the latter type showed an overall efficiency of 53.7 per cent. when raising three pints of water to boiling point, which was equal to the best results obtained with existing types of hot plate. This efficiency was increased to 67 per cent. by roughening the bottom of the kettle and to 75 per cent. by blackening it. The rapid heating of large quantities of water, such as were required for a bath, was not practicable at present; a much more satisfactory arrangement was to provide a well lagged cistern, and to heat the water by means of a small quantity of energy, supplied over a long period. He had had one of these cisterns in his kitchen during the past four months, and it had been found very useful in supplying all the warm water required in the kitchen, and also for a child's bath. Such apparatus, with its high efficiency and load factor, could easily compete with the heating of water by other means.

Perhaps the greatest obstacle to the advance of electric cooking was the first cost of the appliances and of their installation, but this was largely due to the very small demand. In order to introduce it satisfactorily, it would be necessary for some responsible body to obtain complete outfits in large quantities and to dispose of them by means of some system of hire purchase.

Suppliers of cooking apparatus stated that the present inadequate tariffs were responsible for the small demand and consequent high cost of apparatus, whilst undertakers replied by questioning the use of a special tariff for so small a number of consumers. He thought the supply authorities should take the first step, and by introducing a suitable and payable tariff, they would very soon increase the demand.

The individual load factor of an average consumer was undoubtedly very poor, but he reckoned that the average annual load factor of a number of such consumers would be equal to about 25 per cent. He estimated that from 1,000 to 2,000 cooking outfits could be connected without increasing the maximum demand upon the generating station.

For the tariff, he preferred a system wherein a fixed monthly charge (depending upon the size of installation or probable M.D.) was made, and a secondary charge for every unit consumed. The present was a very opportune time for the adoption of such a tariff, as it would tend to guarantee a definite annual revenue to cover the fixed charges, which were now met by the higher rate charged for lighting.

With regard to public lighting, the advance had been at least as marked as in any other of the spheres of electric supply; here also, reduced cost per unit had been combined with greater efficiency in lamps used.

Ten years ago they had no electric traction in Melbourne, but now there were some 56 miles of single track in successful operation, with 46 miles in course of erection. These were all additional lines erected to meet the great demand for this form of transportation, and the electrification of their tramways, which must be commenced shortly, would greatly increase these figures. The electrification of their suburban railways was one of the biggest projects of the kind ever undertaken, and would greatly widen the field of the electrical industry in Victoria during the next few years.

Recent years had seen electricity supply extended to the majority of their suburbs, and although extension by any means was preferable to none, it was obvious that some of the modes employed were not the most economical and efficient. A number of the local councils, desirous of running their own systems, purchased current in bulk, and retailed it themselves; this might give fairly satisfactory results, but when matters were further complicated by such a council re-selling in bulk for distribution by a third party, the proceeding was manifestly inefficient.

The units disposed of by Melbourne supply undertakings during the year 1914 amounted to 36 millions, and it was estimated that in five years' time this figure would be augmented as follows:—

Private supply for light and power	35	million units.
Electrification of cable tramways	24	,, ,,
Additional tramways	10	,, ,,
Total increase	69	,, ,,

This gave an estimated output of over 100 million units per annum, which, added to 129 million units, estimated to be generated for the suburban railways, would make a total output of 229 million units for Melbourne and suburbs.

The rapid extension of the undertakings had materially affected the systems of generation and distribution of energy.

Ten years ago (as at present) the major portion of the energy was generated by two stations, the centre of the city being supplied with D.C. at 460 volts, and the suburbs with single-phase A.C. supplied through 2,000-volt overhead feeders and house transformers. To overcome the unreliability, danger, and inefficiency of the latter system, underground mains had been laid to sub-stations, where the current was converted from 4,000 to 400 volts to supply local networks of bare hard-drawn copper. The size of generating units during the period under review had increased from 350 KW. to 5,000 KW. Owing to the difficulty experienced in obtaining reliable direct-current generators of sufficient size, it was deemed advisable to install three-phase generators at the supply station and obtain D.C. by means of converters. Most of these converters had been placed in a sub-station near the centre of that half of the D.C. area which was farther from the works, thus tending, not only to minimise the units lost in mains, but to increase materially the capacity of feeders already laid.

Three-phase supply was being given to some of the neighbouring municipalities, and it was intended ultimately that the existing single-phase system should be supplied from the three-phase generators by means of two sets of auto-transformers placed across the outers, so that eventually the whole of the generation in the city station might be carried out by the three-phase plant.

When the existing stations were designed, the huge outputs which he had forecasted were not anticipated, and in a few years the sites would become inadequate. When this time arrived, it would probably be advisable to select a site with access to fuel by land and water, and with an ample supply of water for condensing purposes. High-tension three-phase current would be supplied to the existing undertakings for the necessary transformation; and as the plant in existing stations became obsolete, or relatively inefficient, the load would be taken up by this new station.

A NEW PRINTING TELEGRAPH SYSTEM.

THE excellent work done by Mr. Donald Murray in developing first the automatic printing telegraph system, which we described in our issues of March 13th-April 3rd, 1903, and later the Murray multiplex system, described by the inventor in a paper before the Institution of Electrical Engineers (abstracted in the ELECTRICAL REVIEW, May 19th, 1911), is well known to our readers, and the latter has been extensively adopted by British and foreign administrations. In 1912, Mr. Murray sold his U.S. patent rights in the multiplex system to the Western Union Telegraph Co., and the latter entered into collaboration with the Western Electric Co., of Chicago, with a view to the development of the invention; a detailed description of the apparatus as manufactured by the latter company was recently given by Mr. PAUL M. RAINEY in the *Electrical World*, from which we extract the following particulars:—

Some of the various methods of operation which have been standardised are as follows:—

1. *One-Way Method of Operation.*—This method provides one traffic channel, which may be used in either direction at the rate of 45 words per minute. This system is intended for short-haul traffic over lines comparatively free from inductive disturbance and not exceeding the equivalent of 90 miles of underground cable.

2. *Two-Way Method of Operation.*—This method of operation provides one traffic channel in each direction simultaneously without involving the use of duplex balancing apparatus. Its traffic-carrying capacity is equal to, roughly, 45 words per minute in each direction, or a total of 90 words per minute for the line. This system is operative over any length of line not requiring the use of repeaters. For economic reasons it would ordinarily not be used for lines longer than 500 miles.

3. *Double-Duplex Method of Operation.*—This method of operation provides two traffic channels in each direction. Simultaneous transmission in each direction is obtained by means of the duplex balance. The traffic-carrying capacity of the circuit is, roughly, 45 words per minute per channel, 90 words per minute in each direction, and a total for the line of 180 words per minute.

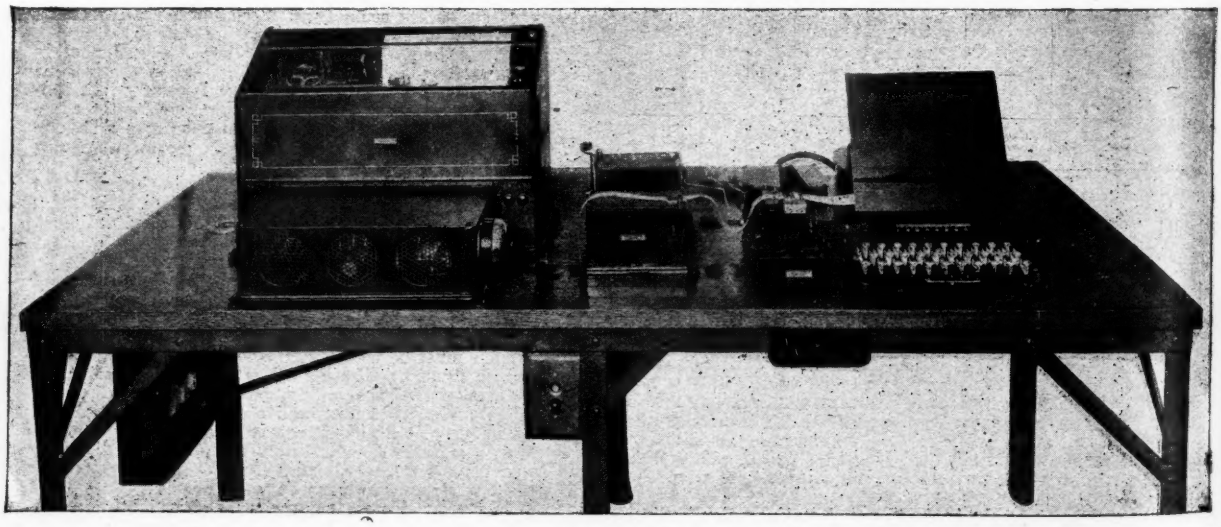
4. *Triple-Duplex Method of Operation.*—This method of operation provides three channels in each direction, simultaneous transmission in two directions being obtained by means of the duplex balance. The traffic-carrying capacity is, roughly, 45 words per channel, 135 words per minute in each direction, or a total of 270 words per minute for the line.

5. *Quadruple-Duplex Method of Operation.*—This method of operation provides four channels in each direction, the simultaneous transmission in two directions being obtained by means of the duplex balance. The traffic-carrying capacity is, roughly, 45 words per channel, 180 words in each direction, or a total of 360 words per minute for the line.

The methods of operation described above by no means represent the limit of flexibility of the system, for if line conditions will permit, the number of channels may be further increased. Moreover, the working speed per channel is not limited by the apparatus, but rather by economical operating conditions. Forty-five words per minute is thought to be an economical working speed. Satisfactory operation of the apparatus has been had at 52 words per minute per channel on a quadruple-duplex, thus making a total of 416 words per minute for the line.

In the case of the quadruple-duplex, triple-duplex, double-duplex, and two-way services, the messages are first prepared on tape by an operator using a keyboard perforator, as shown at the right of fig. 1. When each key of the perforator is depressed, several holes are punched in the tape, and their arrangement determines the combination of positive and negative currents which will be sent to line when the tape is fed through a transmitter (fig. 1) working in conjunction with a distributer (fig. 6). The impulses thus transmitted over the line operate a polarised line relay at the receiving station, which, in conjunction with another distributer, passes the impulses along to a receiving printer (fig. 1, left), which translates them into the predetermined letter or figure and prints them in column form, so that when a message is completed it may be torn off and is ready for delivery. If so desired, the message may also be received in the form of a perforated tape. This is accomplished by means of a re-perforator which works in conjunction with the printer. The tape thus prepared may be used for retransmission on another line operated by any of the methods described above.

Ordinarily, for one-way service, keyboard transmission is adopted, instead of tape transmission. In either case the



RECEIVER. TRANSMITTER. PERFORATOR.

FIG. 1.—COMPLETE TRANSMITTING AND PERFORATING EQUIPMENT.

home printer may or may not be used to provide a record of all traffic passing over the circuit. However, when desired, use may be made of tape transmission for this class of service, which possesses the advantage of affording a simple and efficient storage of signals, thus keeping the speed of transmission constant. This is of particular advantage in operating over a difficult circuit; for example, a line which would easily permit of a fair average speed, but which would not be capable of transmitting the signals at the maximum speed of the operator.

The code used in this system is an equal-letter five-unit code; that is, each signal consists of five units or current impulses, and all signals require the same amount of line time for their transmission. This is generally known as the Baudot code, because of its use in the Baudot system, which has been extensively used throughout Europe, particularly in France, for upward of 30 years. In a five-unit code, assuming that each unit is represented by a pulse of positive or negative current, there are available 31 combinations which are sufficient for all the letters of the alphabet and the functions—carriage return, line feed, letter shift, figure shift, and space. The various figures and additional functions are obtained by preceding these signals by the figure-shift signal. Before returning to letters, it will then be necessary to send the letter-shift signal. In addition, the column printing feature requires signals to lift the paper vertically and return the carriage for a new line. The transmission of these extra signals over the line occupies line time, and this loss of time has been found to average about 10 per cent. of the working time, for ordinary telegraph traffic. In other words, the code employed in this system may be considered to average 5.5 units per character so far as line transmission is concerned. As regards the economy of line time, the five-unit code has an advantage over the Continental Morse code as 5.5 is to 9.08, an advantage of 65 per cent.

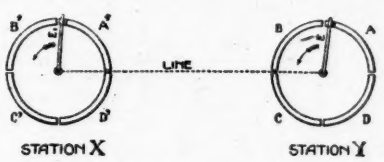


Fig. 2.—Diagram of Multiplex Operation.

The equal-letter code permits of the use of the multiplex principle, which is employed in the quadruple-duplex, triple-duplex, double-duplex and two-way methods of operation. Fig. 2 shows diagrammatically the method employed to secure multiplex operation. If each of two metal rings, one at each station, X and Y, is divided into four quadrants, A, B, C and D, at Station Y, and A′, B′, C′, and D′, at Station X, and rotating brushes E and E_1, are connected to the line as indicated, and if the contact brushes start from the same relative position and sweep over the contact segments with the same uniform angular velocity, quadrant A will be connected through the line with quadrant A′, quadrant B with quadrant B′, quadrant C with quadrant C′, and quadrant D with quadrant D′, once per revolution, the interval of each of these four connections being equal to the time of one-quarter of a revolution of the rotating brushes. If each signal consisted of one pulse of current, it would then be possible to send one signal per quadrant per revolution. If, instead of having solid quadrants, each is divided into five segments, it will be possible

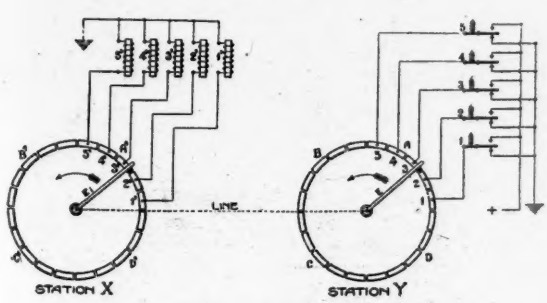


Fig. 3.—Arrangement of Five-part Quadrants.

to use the five segments of one quadrant at one end for the transmission of five current impulses, which constitute the signal for a given letter or figure in the code just described, and the five segments at the other end may be used for receiving these impulses and distributing them in such a manner that they may be used to select the letter determined by the combination of impulses. In fig. 3 the quadrants are shown thus divided; each quarter of the circumference consists of five segments, each segment of quadrant A, station Y, being connected to a contact lever so arranged as to connect this particular segment with the ground circuit or battery, depending upon its position between the fixed contacts, while the segments of quadrant A at station X are connected to the relays as shown. Normally all of the levers 1, 2, 3, 4 and 5 are in engagement with contacts connected to ground. If, now, any lever is moved over to engage its battery contact during the quarter of a revolution in which the rotating brush E moves over the quadrant A, a current impulse will be transmitted to the line through the rotating brush E, and since the rotating brush E_1 is synchronously wiping over the segments 1′, 2′, 3′, 4′ and 5′ at the same time that the rotating brush E wipes over its contacts 1 to 5, the corresponding relay at station X will be momentarily energised. If provision can be made to change the combination of levers during the time that the brush sweeps over the other three quadrants, it will be seen that during each revolution a different signal can be sent from quadrant A to quadrant A′. What has been said regarding quadrants A and A′ applies equally to the other quadrants. Thus it will be seen that the multiplex principle permits us to send and receive four character signals per revolution. In actual operation the functions of the levers at the sending end, station Y, will be performed by the transmitter, and the operation of the five relays 1′, 2′, 3′, 4′ and 5′ is utilised in the printer to select the predetermined letter or figure. It will also be understood that by dividing the ring into a different number of segments it might be possible to send and receive a greater or lesser number of signals per revolution. What has been described above constitutes multiplex operation. If the line is worked duplex, the same can be accomplished in both directions at the same time. An essential requirement of such a system is that the rotating contact brushes at the two ends must be made to rotate in synchronism. This has been accomplished in the system herein described, the means employed being briefly as follows:—

Referring to fig. 4, it will be noted that segments 1 to 5 station at Y are connected to levers 1, 2, 3, 4 and 5, so

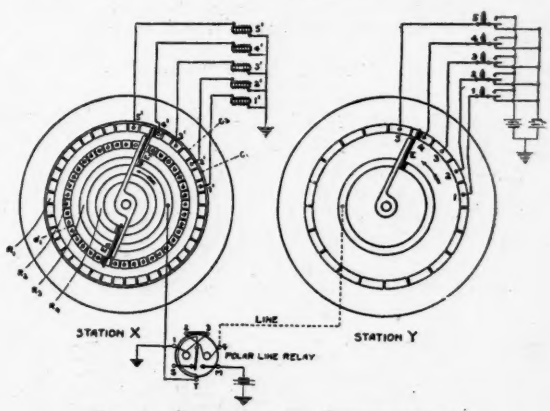


Fig. 4.—Connections to Synchronisers.

arranged that they may send to the line positive or negative current, depending upon their position. The brush E connects these segments consecutively with the solid ring which is connected to the line. At station X the line is connected to ground through the windings 1, 2, 3, and 4 of a polarised relay. The tongue T of this relay is connected to the solid receiving ring R_3. The marking contact M of this relay is connected to a grounded battery, and when negative current from the distant end is passing through the relay the tongue rests on the spacing contact S. As the brush E rotates it connects the solid receiving ring R_3 with the receiving segments 1′, 2′, 3′, 4′ and 5′ of E_1 consecutively. The receiving segments are made shorter than the sending segments, so that the receiving brush E_1 picks out only the centre portion of each current impulse, or of each repeated current impulse, since the signals sent over the line are repeated by means of the polarised relay. Assuming perfect synchronism between the sending brush E and the receiving brush E_1 the receiving brush should be at the point C_1 midway between receiving segments 1′ and 2′ when the sending brush passes from segment 1 to segment 2, and at C_2 midway between receiving segments 2′ and 3′ when the sending brush passes from segment 2 to segment 3, and so on. Thus it will be seen that for a change of polarity, which can take place only when brush E passes from one segment to another, the receiving brush E_1 should be at some point in the circumference midway between two receiving segments. The receiving distributor is therefore provided with additional rings F_2 and F_4, called correcting rings. R_4 is a solid ring connected consecutively to the segments in R_2 by the brush E_2. These segments are half the length of the sending segments, and are, therefore, double in number. They are connected into two groups—*a* and *b*, as indicated. The brushes are so arranged that when the receiving brush E_1 is midway between any two receiving segments, say at O_1, the correcting brush E_2 is just about to engage one of the *a* segments, say at d_1. Circuit provisions are made so

that a short pulse of current is generated locally at each reversal of the line current. When this reversal finds the correcting brush E_2 on an *a* segment it causes the operation of a mechanism which automatically sets back both brushes E_1 and E_2. Now, if the motor driving the receiving distributor is arranged to run slightly faster than the motor driving the sending distributor, the tendency will be for brushes E_1 and F_2 to be gaining, and the intermittent stepping back, as already described, will result in maintaining the receiving brush E_1 in the proper phase with the sending brush E at the other end of the line. It will thus be seen that at each reversal of the line current the position of the correcting brush on the segmented correcting ring determines whether a correction of phase relation shall be made. Since the motor at the receiving end is running faster than the one at the sending end, sooner or later it will engage an *a* segment at the time of a current reversal. This causes the brushes to be stepped back through a small angle, so that the current reversals take place only while the correcting brush is on *b* segments. Thus the signalling impulses are made to provide correcting impulses, which are used to maintain synchronism.

The shortening of the receiving segments to one-half the length of the sending segments provides an ample angle for this purpose. It also possesses the advantage that only the

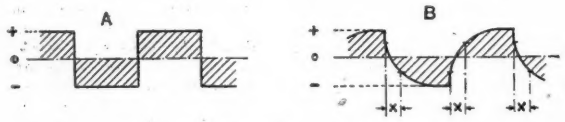


Fig. 5.—Distortion of Signals.

centre portion of the signal is utilised for signalling purposes, and the system is less subject to the effect of inductive disturbances. Diagram A, fig. 5, shows the form of signals sent to the line by the distributor. When the signals are received at the distant end, they are more or less distorted. Diagram B, fig. 5, illustrates this distortion. It is near the point of reversal at the time the line current is weak that inductive disturbances are able to affect or further distort the signals. If any advantage were to be gained, the segments could be shortened still further, since the relays operated from them are connected in local circuit and require a very short impulse for their operation. It will be appreciated, then, that the shortening of the receiving segments is not a sacrifice in any sense of the word. In actual practice the line is worked duplex and the sending and receiving distributors are combined and run by one motor, means for maintaining synchronism being used at only one end.

Fig. 6 shows the distributor face with the brushes. It will be noted that this is somewhat more complex than the diagrams which have been explained. The outside ring, No. 1, of this distributor is the receiving ring, only alternate segments being used for selecting purposes. The intermediate segments in each quadrant, however, are used for a specific signalling purpose, as will be described later in connection with the printer. The second ring from the outside, No. 2, is the correcting ring and corresponds to ring R_2 of fig. 4. The third ring, No. 3, is the sending ring and corresponds to the sending

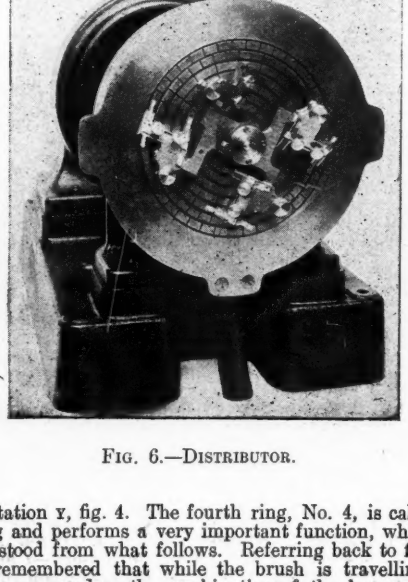


Fig. 6.—Distributor.

ring at station Y, fig. 4. The fourth ring, No. 4, is called the local ring and performs a very important function, which will be understood from what follows. Referring back to fig. 3, it will be remembered that while the brush is travelling over quadrants B, C and D, the combination of the levers 1, 2, 3, 4 and 5 should be changed to the combination of the next letter. Likewise, while the brush travels over quadrants C, D and A, the transmitting apparatus connected to quadrant B should change its combination to the signal of the next letter, and so on. At station X the printer connected to quadrant A′ receives a letter during one-fourth of the revolution, while the brush E_1 is passing over the segments of quadrant A′; but while the brush is passing over the remaining quadrants, B′, C′ and D′, the printer has time to complete its printing operation, move the paper and clear out, so as to be in readiness to receive another signal. The segments in this local ring, No. 4, are used to perform these functions; that is, certain segments are used to change the signal combinations set up in the different quadrants. Likewise, they are used to start the printing mechanism after selection has been made, so that it may be able to complete the printing operation in time to receive the signal for another letter. It will be noted

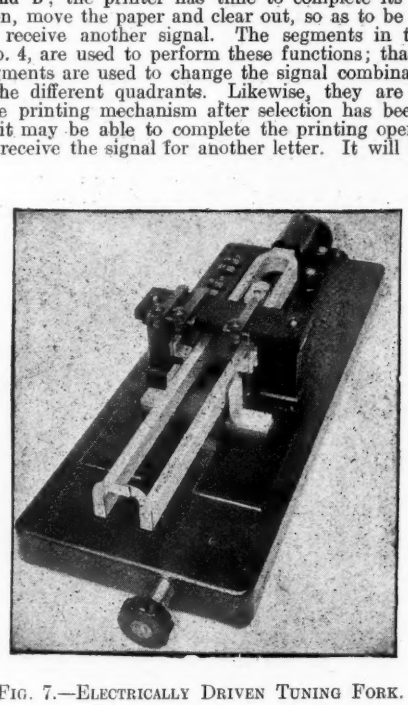


Fig. 7.—Electrically Driven Tuning Fork.

that the brushes connect these various segmented rings with solid rings 5, 6, 7 and 8. Each brush holder is insulated from the spider, and the individual brushes are made up of a number of strands of small hard-copper wires.

The motors used to drive the distributors are of the well-known phonic wheel type and are driven by impulses from an electrically driven tuning fork. This assures a constant rate of vibration, since the frequency of a tuning fork varies by only about 0.01 per cent. per deg. C., and is little affected by changes in voltage applied to the driving magnet. Fig. 7 shows the fork used, while the motor distributor and mechanical corrector are shown in fig. 8. The mechanical corrector, which is shown mounted between the distributor and the motor, is the mechanism which is arranged to step back mechanically the brushes when they have advanced too far, as already explained. The speed of the motor is determined by the rate of vibration of the fork. Large changes in the rate of vibration of the fork are accomplished by adding weights to the two prongs, a set of weights being provided with each fork. Small changes in the speed of the motor (a

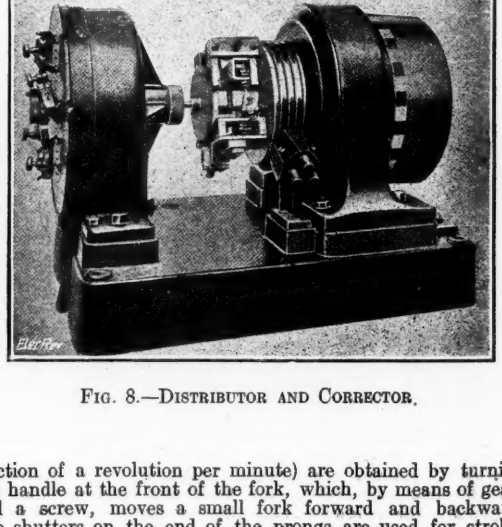


Fig. 8.—Distributor and Corrector.

fraction of a revolution per minute) are obtained by turning the handle at the front of the fork, which, by means of gears and a screw, moves a small fork forward and backward. The shutters on the end of the prongs are used for stroboscopic observation and are not essentially a part of the system.

(To be concluded.)

TWO AMERICAN ELECTRIC FURNACES.

Amongst the ever-widening uses to which electricity is now being put, none promises a greater sphere of usefulness than its application to furnace heating and for melting purposes. The electric furnace may be said to have gone a long way towards solving the fuel difficulty in those countries where solid fuel is costly and water power plentiful, and it is in localities where such conditions prevail that the greatest progress in electrical furnace practice may be expected. In the refining of steel in particular, the electric furnace is now playing an important part, as due to the greater accuracy of control and improved conditions of operation, a much superior product can be ensured, than under pre-electric conditions, and there are at the present time over 70 electric steel furnaces in use in Europe and America.

In a paper read at the San Francisco Convention of the National Electric Light Association, Mr. W. M. McKnight described the first Stassano arc furnace to be installed in the States. This furnace was at the Warman Steel Casting Co.'s works at Redondo, Cal., its introduction being due to the costliness of the crucible process on the Pacific coast.

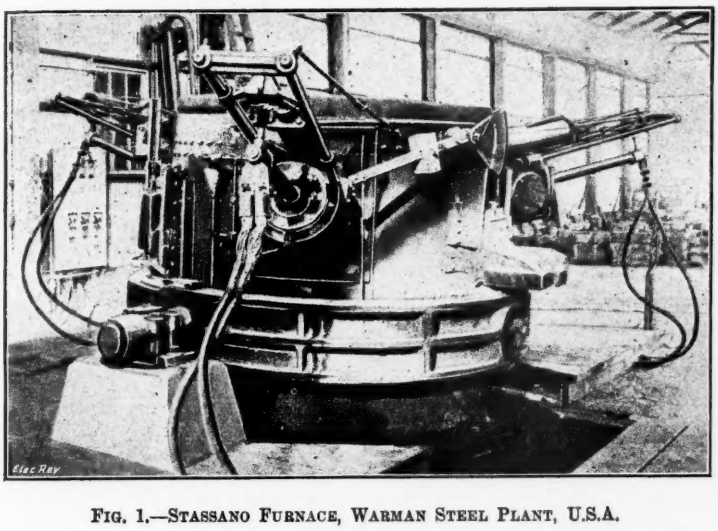


Fig. 1.—Stassano Furnace, Warman Steel Plant, U.S.A.

The Stassano furnace, which has now been in continuous use in these works since November, 1913, except for relining intervals, has a capacity of 1 ton, and six heats can be operated daily: deducting time taken in relining, there are 24 full operating days of 24 hours each per month. It requires two days three times a month to reline the furnace, magnesite bricks being used, the cost being $225 per lining, including labour and material, no cement being required.

The furnace turns out steel castings of up to 1,600-lb. weight for automobile fittings, gears, water-wheel buckets, and where great strength is required. Its primary features are a completely closed melting chamber, and a three-phase electric arc above the metal, preventing the carbon and other electrode impurities from entering the metal, and allowing a thorough mixing during any desired time. The metal reaches approximately 3,000° F. before being poured.

The furnace is suspended in trunnions and tilted for skimming and pouring the metal by means of gearing. The three electrodes dip towards the centre of the furnace at an angle of about 15°, converging to a point about 2 to 3 in. above the metal. The average arc is about 10 in. long, although at times an 18 in. arc is drawn.

While the original furnace was closed at the top, the Warman Co. has altered it so that the roof is removable and additional furnaces to be installed shortly will embody this improvement.

The carbon electrodes are 3½ in. in diameter and 6 ft. long and burn down to stubs about 18 in. long. The electrodes enter the furnace through a water jacket and are fed individually by hydraulic pressure regulated from control valves at an operator's stand, the water being circulated by a 2-H.P. motor-driven pump through a cooling tower to a tank which supplies the water jackets and the hydraulic control, under a 20-ft. head.

The current consumption of the furnace is from 800 to 2,000 amperes per terminal on a three-phase 150-volt circuit. Current is supplied through flexible cables connected to three single-pole double-throw and one three-pole double-throw knife switches, connecting the transformer secondaries in either interconnected star or delta, at pressures of 150 and 100 volts respectively, with the furnace.

To keep the balance a ground connection is tapped through an oil switch and overload release to the middle point of the Y on the main circuit. Heavy copper bus-bars lead from the switches to the secondary terminals of three 100-K.V.A. Westinghouse transformers, which are specially designed, oil cooled and wound for 10,000 volts primary and 110 to 150 volts secondary.

The entire consumption for the installation is registered by a primary meter, which together with the transformers is placed in a galvanised iron sub-station, and controlled by a 10,000-volt oil switch with overload trip coils; the service is protected by a fused pole-top switch operated from the ground.

The double transmission line is fed from two near-by sub-stations, each having an approximate capacity of 2,000 KW.; these sub-stations are supplied from the Southern California Edison Co.'s 10,000-volt and 33,000-volt transmission lines.

Aside from steel, ferro-silicon, ferro-manganese and anthracite coal having 90 per cent. of fixed carbon, are ingredients necessary to the finished product.

There is very little variation in load from day to day, as shown by graphic chart, the average demand being about 225 KW. The fluctuation of the load, which is non-inductive, scarcely affects the regulation of the 10,000-volt line.

Another American furnace described by Mr. W. P. Lass in the *Mining and Engineering World*, is one used by the Alaska-Treadwell Gold Mining Co. for treating by-products; this by-product, consisting of 2 tons of slag, 300 lb. of matte, 500 lb. of refinery refuse, flue dust, &c., was formerly treated in a 24-in. water-jacketted blast furnace, but in 1914 a single-phase electric furnace was substituted.

The furnace was constructed from an old steel acid drum, in the bottom of which a cable of bare copper strands was introduced, the strands being spread fan shape, and embedded in powdered graphite to form the lower electrode.

The furnace sides were built up of fire-brick, leaving a chamber 14 in. in diameter and 20 in. high. The upper electrode is of graphite or carbon rod 3 in. in diameter, arranged to joint to new lengths without shutting down or wasting stubs. The arrangement of the furnace is shown in fig. 3. Three openings in the cover provide for feeding the charge, for gas escape and for the centre electrode, the latter being large enough to allow of charging round the electrode; escaping gases are extracted by a fan, the furnace being operated on a lighting circuit through a 50-KW., 60-cycle, 110-volt transformer.

A water rheostat is provided to lower the voltage when starting or when there is a bath of metal in the bottom of the furnace, which would otherwise allow too much current to pass. The material to be treated in the furnace is mixed in certain proportions, the material added during the melt being 8,507 lb., of which 5,870 lb. is by-product material—old slag, the residue from burning old mill launders, sweepings, &c., of the following percentage compositions:—SiO_2 40·1, Fe 16·0, CaO 16·1, Cu 5·9, Pb 3·0, Zn 5·7, Al_2O_3 2·0, S 3·6, moisture 4·0, gold $1,096·6 per ton. Coke is added to the charge as a reducing agent.

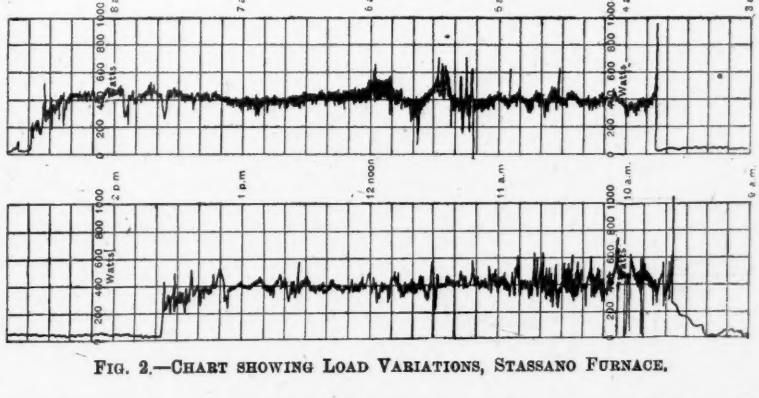


Fig. 2.—Chart showing Load Variations, Stassano Furnace.

In starting, the furnace operates as an arc furnace until thoroughly hot, when the charge is added, the electrodes being raised as the current increases until the chamber is filled with the charges and the upper electrode extends into the melt a foot As the charge continues to melt, the electrode is moved, keeping the amperage nearly constant. At this stage the furnace has automatically transformed itself into a resistance type furnace, the molten charge acting as a resistant.

After the charge is in quiet fusion (about 2 hours 10 min.) power is turned off, and the charge allowed to settle before tapping.

Both graphite and carbon electrodes are used, the former costing $2.95 each, and the latter $1.20; power cost is less than 1 c. per KW.-hour.

The labour required for the operation of the furnace, including

charging and tapping, is one half one man's time, when melting 1 ton in 24 hours. The following data is given :—

Running time, 128 hours 40 minutes.
Average weight, charge added, 160·5 lb.
Average fusion time of charge, 2 hours 25 minutes.
Total number charges, 53.
Graphite electrodes used, 1 per 24 hours.
Total power used, 4,440 KW.-hours.
Power per lb. material fed, ·52 KW.-hour.

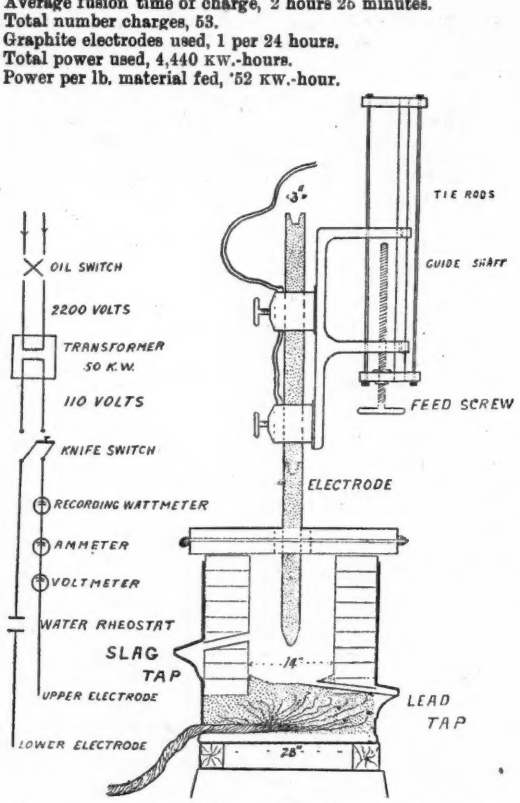


FIG 3.—SECTIONAL DIAGRAM, ELECTRIC BY-PRODUCT FURNACE.

The electric furnace shows a saving in mechanical loss of gold in flue dust; results in a lower grade slag, allows of fine temperature regulation, and benefits the health of the operators (who are not specially trained in its use).

COMPARATIVE COSTS OF VARIOUS TYPES OF PIT LOCOMOTIVES.

ALTHOUGH pit locomotives are very little, if at all, used in this country, the following data, referring to tests carried out under as similar conditions as possible in a number of German coal mines, are of interest as indicating Continental practice and experience; complete details of the installations and trials appeared in *Glückauf*. The object of the present tests was to compare the costs of compressed air, accumulator, D.C. trolley and single-phase pit locomotives. The track and load conditions in the several cases examined are shown in Table I.

TABLE I.

Type of locomotive.	H.P	Average gradient (parts in 1,000).	Length of route (metres)	No. of laden trucks.	Weight of laden train (kg.)	Performance per 7-hour shift. Total t. km.	Useful t. km.
Compressed air...	35	3·33	1,290	35	32 800	615	325
Accumulator ...	16	1·25	1,100	25	25,300	446	226
D.C. trolley ...	30	2·78	1,300	30	31,040	765	423
One-phase—A ...	30	3·45	1,500	30	29,150	815	392
—B ...	40	3·45	1,500	40	39,000	900	420
—C ...	30	+ 4·35; − 2·86; + 1·6	1,250	35	40,865	962	430

The battery locomotive installation was supplied from a 3,250-volt three-phase line through a rotary converter at the pit bottom, feeding a charging station in-bye. The overall efficiency from generator to battery was about 42 per cent., that of the battery alone being 65 per cent. The station output averaged 0·12 per total and 0·23 KW.-hour per useful (coal) ton-km.

The D.C. trolley installation was supplied through motor-generators from a 1,000-volt three-phase network, and the overall efficiency, allowing for light-load losses and 2 per cent. loss in the H.T. conductors, was 53·2 per cent. In this case, the station output was 0·08 and 0·15 KW.-hour per total and per useful ton-km, respectively.

Three types of single-phase locomotive were tested, supply being taken from 1,000-volt three-phase mains through track transformers supplying overhead trolley wires. The overall efficiency of this scheme was found to be 74·5 per cent., and the station output averaged 0·16-0·17 KW.-hour per useful ton-km.

The average total cost data as shown in Table II assume the cost of energy to be 0·35d. per KW.-hour, and allow 4s.-5s. wages per man per shift and 300 working days, each of two shifts, per annum : 5 per cent. interest is charged and 25 per cent. depreciation is reckoned on locomotives, 10 per cent. being allowed on H.T. equipments, converters, buildings, reserve plant, &c. The capital cost of the type of accumulator locomotive tested was £670, that of the D.C. trolley locomotive, £355, and that of the single-phase locomotives from £345 to £420. Part 1 of Table II assumes the

TABLE II.

Total costs, Pence per		Accumulator.	Compressed air.	D.C. trolley.	Single-phase.
(1) Total t. km.	...	0·530	0·435	0·294	0·247
Useful t. km.	...	1·120	·822	·517	·494
(2) Total t. km.	...	0·587	0·435	0·340	0·305
Useful t. km.	...	1·150	·822	·646	·611

locomotives to be worked to their full capacity; there is little difference between the total costs of the D.C. and single-phase trolley installations, but these are considerably cheaper than compressed-air locomotives and still cheaper as compared with accumulator locomotives. If the equipment is not worked to its full capacity, but is idle for, say, 1·5 hours in each 7-hour shift, it will usually be possible to refill air tanks or change accumulators during these intervals, and, by thus avoiding interruption of service for these operations, the specific cost of working air or accumulator locomotives rises more slowly than that of trolley locomotives, as is shown by part 2 of Table II. Where yet longer idle intervals occur in working, the specific cost of all the systems considered rises in about the same proportion.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrically-propelled Chairs.

The expositions now in progress on the Pacific coast offer visitors the novelty and comfort of riding about the broad intramural avenues in silent, easy-going electric roller chairs. More than 200 such chairs are in use at the San Francisco fair, and a lesser number are in service at San Diego, where the accompanying photograph was taken.

Each chair carries two persons, one of whom steers and controls the chair. The average speed is about 3 miles per hour. Some of

FIG. 1.—ELECTRICALLY-PROPELLED CHAIR.

the chairs are equipped with extending bumpers which are connected with the control apparatus and brakes. If such a chair runs into an obstruction of any kind the pressure on the bumper instantly throws off the power and sets the brakes, bringing the car to a stop within a few inches. The battery equipment averages ten 150 ampere-hour cells, which are capable of operating the 0·5 H.P. motor about eight hours on one charge.—*Electrical World.*

Domestic Water Heating.

In order to get over the difficulty of water heating where consumers are substituting electric for coal ranges, the WASHINGTON WATER POWER CO., of Spokane, has developed an electric water heater, to be connected with the ordinary domestic hot-water tank, and operated when the customer's electric range is not in operation.

The heater consists of a brass tube about 3 ft. long, and having an internal diameter of 1·75 in. Around the tube is wound a

double spiral of square copper wire about 0·125 in. wide and spaced 0·125 in. apart. High-resistance wire is wound in the grooves on asbestos seats, and the entire unit is treated with three coats of enamel and then baked. To minimise heat radiation the unit is insulated with a covering of magnesia.

Tests made with this heater in actual use indicate the following results:—Starting with cold water in the tank, hot water was available in 15 minutes. By permitting the heater to operate during the entire night preceding washday, sufficient hot water was obtained for an ordinary family washing. From February 12th to April 1st, a meter on the tank showed a consumption of 636 KW.-hours, or 13·5 KW.-hours a day. An analysis of the earnings from 12 2-KW. ranges over a period of 100 range-months showed that they consumed on the average about 780 KW.-hours a year each, or 2·1 KW.-hours a day.—*Electrical World.*

Electric Supply in a Ball-Bearing Factory.

In the well-known Hoffmann ball-bearing factory at Chelmsford power is supplied for driving the machinery at 110 volts; the generators are driven by Diesel engines, and the first installation comprised two 220-KW. "Witton" generators coupled to three-cylinder Diesel engines, having cylinder dimensions of 450 mm. diameter × 660 mm. stroke. A recent addition to the plant took

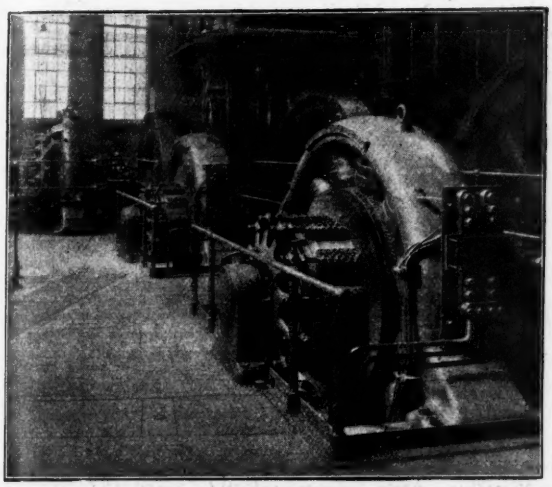


FIG. 2.—GENERAL VIEW OF THE TWO 220-KW. AND ONE 700-KW. "WITTON" GENERATOR IN THE BALL-BEARING FACTORY OF THE HOFFMANN CO.

the form of a 700-KW. "Witton" generator driven by a four-cylinder Diesel engine, with cylinder dimensions of 510 mm. diameter × 660 mm. stroke. This engine has water-cooled pistons and cylinders. At the low speed of 187 R.P.M. the machine had large dimensions, and the problems involved in its construction

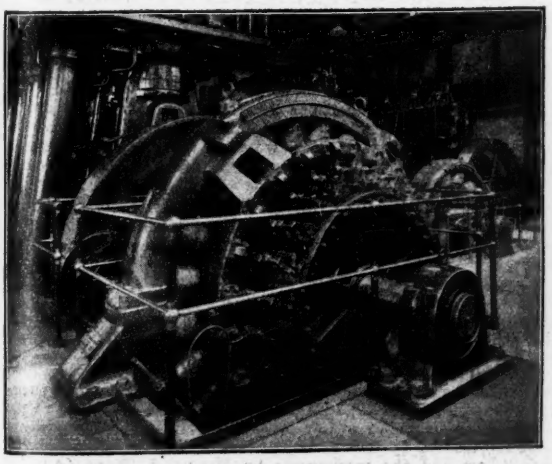


FIG. 3.—THE 700-KW. "WITTON" GENERATOR, FITTED WITH "HOFFMANN" ROLLER BEARINGS.

can be realised by the fact that the full load current of the generator is 6,400 amperes. Special care was taken in the design and construction of the commutator and brush gear, a split commutator being adopted to carry the heavy current. An interesting feature of the installation is the fact that the machines are equipped with "Hoffmann" roller bearings.

The generators for this installation were supplied by the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C.

Helsby Patent Condensers.

The growing importance of improving the power factor in A.C. systems, together with successive improvements in the construction of condensers, has had the natural result; "power" type condensers are now made by the BRITISH INSULATED AND HELSBY CABLES, LTD., of Helsby, who have just issued a

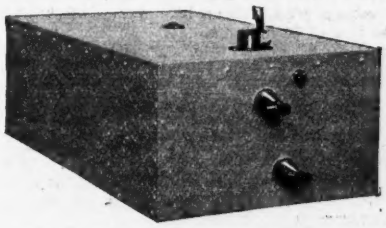


FIG. 4.—BOX OF 50 1-MFD. HELSBY PATENT CONDENSERS.

descriptive pamphlet on the subject. The Helsby patent "Power" type condensers are of the Mansbridge self-sealing type, and are either "oil-immersed" or "solid impregnated," the former type being recommended in cases where the working pressure exceeds 250 volts A.C., and the condensers are continuously in circuit. They may be employed for improving power factor, suppressing arcing at contact-breakers and in switches, for reducing the current or

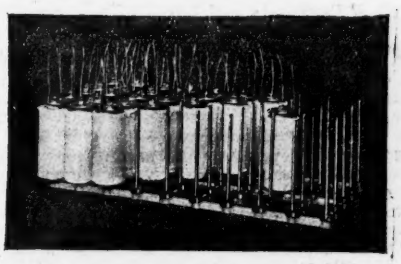


FIG. 5.—METHOD OF MOUNTING CONDENSER UNITS OF 1 MFD. EACH.

voltage on electromagnets and other electrical devices in high-pressure circuits, for wireless telegraphy, and for other purposes. The Mansbridge system of construction has been fully described in our pages; it consists essentially in the use of paper coated on one side with metal, two such sheets being rolled up together so as to form a cylinder.

Amongst other advantages, this method of construction possesses that of being self-sealing; if a pin-hole in the paper permits of a short circuit, the spark volatilises the thin coating of metal in the neighbourhood of the defect and the insulation is restored. The

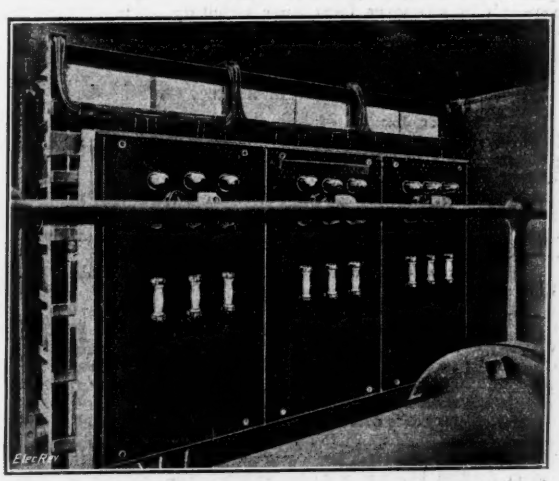


FIG. 6.—HELSBY OIL-IMMERSED THREE-PHASE CONDENSER OF 165 K.V.A.

dielectric losses are very small, the efficiency at ordinary frequencies and temperatures being over 99·5 per cent.; and the temperature rise of large capacities at rated voltage and 50 cycles does not exceed 20° F. The condensers are manufactured in units of about 1 MFD., and are suitable for working pressures up to 550 volts A.C.; the units are assembled in strong sealed metal cases in such numbers as may be required, but preferably not exceeding 50 MFD. in one case. These cases are further

assembled in strong wrought-iron frames or cast-iron cases, and provided with suitable switch and fuse gear. Fig. 4 shows such a 50-MFD. case, measuring 10 × 11 × 7½ in. and weighing 75 lb.; and fig. 5 shows the method of mounting the units. Fig. 6 is a view of an oil-immersed three-phase condenser of 1,740-MFD. capacity, installed in a colliery generating station; the output is 165-K.V.A. at 550 volts, 50 cycles per second. Such a condenser used in conjunction with a generating set supplying 460 K.V.A. at a power factor of 0·6 would reduce the K.V.A. to 350, and improve the power factor to 0·85, thus enabling the generator to deal with an increased load of 30 per cent.

The pamphlet points out the advantages of condensers over running machinery for improving power factor, including the convenience of connecting a condenser directly to each machine that has a low power factor, and thus providing the compensation at the precise place where it is needed. The principles of power factor improvement are also explained, with examples showing how to ascertain the amount of capacity required. As a rule, it is sufficient to correct the power factor to 0·95, as the amount of capacity required to raise it to unity is much greater in proportion than at lower power factors.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Staff Engineers and Labour Exchanges.

With regard to the present regulations requiring all applicants for positions to make their applications through the Labour Exchanges, I think it advisable to call attention to possible abuses which are in danger of being overlooked.

The officials of these places are accustomed to inquiring as to an applicant's character, &c., from his last employer. Presumably they will do so in the present circumstances, whether the applicant be a workman out of work or a staff engineer applying for another post. It has always been accepted that applications for staff positions are treated as confidential by the advertiser, to avoid any trouble between employé and employer. There now seems to be a possibility of the introduction of the Exchanges breaking down this most desirable understanding. In many cases doubt as to this point has prevented many men applying for positions for which they are well qualified.

Again, what is there to prevent an unscrupulous employer stating, irrespective of its truth, when such an inquiry is made, that the employé in question is on war work, thus blocking the way to his advancement for selfish ends, and enabling himself to retain the man without increase of salary?

In addition, cases have occurred where men, who have obtained a post elsewhere, have been told that under the new Act they could not leave their present work, even where these men could not, with any truth, be said to be engaged on munitions (as at present defined).

As in these ways men willing to serve their country have been held, and as there is still likelihood of similar acts against the spirit of the Munitions Act to the men's detriment, as well as the country's, a statement from some authority as to the position seems to be required.

Alcor.

Units from Refuse.

In reply to Mr. Morgan, of course we all know that the refuse in his part of the country and around London is generally very poor stuff, but after all it is a very small portion of the United Kingdom to which this does apply, and even in such places refuse is worth using. As Mr. Morgan shows, the existing stations where fuel is very expensive are naturally equipped to burn coal economically, and therefore they can do likewise with refuse as a fuel.

I must not pretend to know as much about the conditions at Horsham as Mr. Morgan, but I should be interested to know whether he has gone into the matter of buying washery dust instead of coal and mixing it with his refuse, so that his destructor would carry him through both his day and evening shifts. In other words, why should not the Horsham refuse be brought up to the same calorific value as the Aberdare refuse by means of very cheap washery dust stored in a hopper above the refuse bin, and a little let down every time refuse is tipped? It will come as a surprise to Mr. Morgan (as it did to me when I arrived here) to learn that coal in Aberdare is not even "fairly cheap," and especially does this apply to house coal. The larger pits around here sell the best *steam* coal in the world in very large quantities, and do not trouble themselves by small local sales. I find in normal times that house coal from Lancashire is cheaper than in Aberdare, taking railway carriage and cartage into consideration.

The only criticism of Mr. Morgan's plant that I make is that the combustion chamber—like mine—appears to be away from the boiler tubes, and that he does not therefore get anything like the full benefit of the heat.

A. J. Abraham, *General Manager,*
Electricity and Tramways Department, Aberdare.
August 16th, 1915.

The Late Mr. Robert Hammond.

I have read with very much interest your obituary notice of the late Mr. Robert Hammond, of whom too much good could not be said. I was associated with him for years at 110, Cannon Street, and well remember his bluff manner and "bronze" laugh, as it was called.

The tales I could tell about the "Brush" 40-lighters, their 2,000 volts and bare copper conductors, would be unbelievable nowadays.

He loved a joke—often at his own expense—and the book you refer to, entitled "The Electric Light in Our Homes," in the production of which I had the honour of assisting, produced endless fun. I have a copy somewhere. It was written in conjunction with a tour round the principal towns of England to demonstrate the advantages of *the* light.

The travelling "properties" comprised a portable drawing-room, about 15 ft. square, a set of 24 large accumulators (fully charged), and other things. The railway charges for accumulators in those days were wicked, and when I called Mr. Hammond's attention to them (to Exeter £1 each—£24), and explained that it was because they were "full," he said return them as "empty"; and I did so ever after. I suppose the railway people won't stand that now.

One thing I think deserves mention, and it, curiously enough, relates to one of that select company still with us, but of whom so many have gone. I refer to Mr. Ferranti, who about 1882 or 1883 came along with his A.C. machine. No one would look at him (in a business sense) until Mr. Hammond did, and the firm of Ferranti, Thomson & Ince, of Appold Street, resulted.

The Lowrie-Hall development came after this, and was really engineered by Fowler's, of Leeds, but it was owing to Mr. Hammond's insistence—backed with money—that electric lighting, so far as the development of the alternating current is concerned, has much to be thankful for.

Harry South.

London, W., *August 16th*, 1915.

WAR ITEMS.

War Relief Funds, &c.—The employés of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., have, since September last, been contributing to the National Relief Fund, British Red Cross Society and Belgian Relief Fund, and last week the total reached £1,002. £500 has been sent to the first-named fund, £250 to the Red Cross Society, and £225 to the Belgians, leaving a balance in hand of £27. This, it will be agreed, is an admirable record, and an excellent example to other works.

The Board of Education has issued an appeal for books for the 4,000 British civilian prisoners of war now interned at Ruhleben, in Germany. These books are needed for use in the educational classes in connection with the "Camp Education Department," which has recently been formed for the benefit of these civilian prisoners, and a list of the works specially required can be obtained from Mr. Alfred T. Davies, Board of Education, Whitehall, London, S.W., to whom all communications on the subject should be addressed. It will be noted that ordinary books, novels, &c., are not required; no books should be sent but those named in the list.

Germans in Russia.—The public subscription of 500,000 roubles to support victims of the war has, says the *Novoye Vremya*, led to a discovery showing the ramifications of German operations in Russia, even at the present time of war. Among the subscribers was the firm of Bogan & Co., of Moscow, whose nationality, when attention was drawn to the firm's name, was speedily shown to be German; two of the partners, named Mark, had, indeed, become naturalised immediately on the declaration of war. Moreover, a syndicate was formed at Petrograd under the style of the Union of Cable Manufacturers, partners in which were the firm of Bogan & Co., and the firm of Felten & Guilleaume, of Mannheim. This syndicate now dictates the price of copper in Russia, as it is part owner of the works at Bielaretz, Kolchurgin, and other places, practically controlling the output of copper goods. The firm of Bogan having interests also in the copper mines in the Caucasus and the Ural, disposes of immense stocks of copper, and some idea may be formed of the profits earned by the syndicate from the rise in prices of from 50 to 100 per cent. in copper, and from 75 to 100 per cent. in copper goods.

Patriotic Tramway Men.—The Manchester Corporation Tramways Department has just compiled another roll of honour, giving the names and addresses of the employés who have joined the Colours. The list contains the names of more than 2,000 men and youths who have responded to their country's call.

Women Munition Makers' Wages.—The wages to be paid to women engaged in Manchester engineering shops which are turning out munitions have given rise to a dispute. It appears that a conference took place a few days ago at which the employers were represented by Messrs. W. Collinwood, A. P. Wood, and F. G. Goodbehere, and the workpeople by Messrs. J. Binns (A.S.E.), R. H. Coates (U.M.W.), and J. Rowan (Electrical Trades). A proposal was put forward for a £1 a week minimum for all women over 18 years old engaged on munitions, but the employers declined to pledge themselves to the proposal, and it is now probable that the matter will be taken to arbitration. Mr. Rowan, of the Electrical Trades Union, stated in an interview that employers showed a strong inclination to employ women in the making of shell parts. In quite a number of shops they were at work on capstan lathes and the like. In seeking to secure a minimum of £1 a week for the women the Trade Unions, in his opinion, were making a reasonable claim.

LEGAL.

Electric Accessories Dispute.

In the City of London Court, on August 12th, before his Honour Judge Rentoul, K.C., a claim was made by Mr. George Braulik, electrical engineer, 8, Lambeth Hill, against Mr. G. H. Banning, Criterion Works, 33, Hurst Street, Birmingham, electrical engineer, for £3 14s. 8d. for Eclipse electric lamps and other accessories supplied. Defendant paid £1 11d. into Court for discount which had been deducted, but disputed the balance. He said he had returned some of the lamps because the voltage was marked on them in ink, and his customers would not have them so marked. They were returned for the voltage to be engraved, and the plaintiff had not since sent them to him. Other lamps sent to him were defective.

Mr. Mayers, plaintiff's salesman, said that the lamps were sent to the defendant in proper condition, and they were returned broken. There was no mechanical defect in the lamps. All lamps were tested before they were sent out.

Judge Rentoul found for the defendant, with costs, and said the plaintiff ought not to have sued a Birmingham man in London for £3 14s. 8d. There was probably the expectation on the part of the plaintiff that the defendant would rather pay the amount than come to London and defend the action.

Theft of Copper.

At Salford, on the 11th inst., Phillip Hawkley (36), of 13, Fern Street, Salford, and Wm. Brookes (53), Hayfield Street, Pendleton, were charged with stealing 1 cwt. of scrap copper, value £5, the property of the British Westinghouse Electric and Manufacturing Co., Ltd. Wm. Dobson (51), 18, Hayfield Street, Pendleton, was charged with receiving the copper, knowing it to have been stolen; and Thos. Wilson (37), broker and coal dealer, of Railway Street, Pendleton, and his brother, Matthew Wilson (31), 2, Peter Street, Pendleton, agent for lamps and fittings, were charged with receiving the property from Dobson, knowing it to have been stolen. Brookes was an outside labourer employed by the Westinghouse Co., and Hawkley was employed in the firm's copper department. All the prisoners were committed for trial at the Salford Sessions, bail being allowed.

There were two other charges against the two Wilsons, and they were committed to the Sessions on these also.

Electrical Work and Council's Test.

A case involving an interesting point to electrical contractors was heard on Thursday last week at the Watford County Court by his Honour Judge Scully. The point at issue was whether payment for electrical work could be withheld until the passing of such work by the local authority, though such testing was not included in the terms of the contract. The action was one in which the plaintiff, Mr. J. W. Russell, electrical engineer, of Loates Lane, Watford, claimed £41 17s. for work done at the residence of Mrs. Charlotte Hunter, of Rothesay, The Avenue, Bushey.

Mr. K. Preedy appeared for the plaintiff, and Mr. Samuel J Duncan for the defendant.

Mr. Preedy said that the plaintiff wired the defendant's house. The important point in the case was that the work had to pass the rules of the Watford Urban District Council's electrical department. The work was completed and the account sent in in April. Defendant sent a letter promising payment, and then wrote stating that as the work had not passed the test of the Council the installation was not complete, and payment would not be made until the test was passed.

The Plaintiff, sworn, said that the Council would not pass the job until the pendants and fittings were all fixed.

Cross-examined: The work was done to the requirements of the Council's rules, but had not been passed. He told the defendant he could not get the work passed until the fittings were fixed. He had not applied to the Council to pass the work, because defendant would not get her fittings out of store. It was not his job to put up any fittings. The complete installation included the fittings, and none had been fixed.

The Chief Electrical Engineer to the Watford U.D.C. said that a cable was laid to defendant's house ready to connect. The installation was not complete until the fittings were up and the light ready to be used. When he inspected the work he found it was work that could be passed.

Cross-examined: The work was done according to the Council's rules, but it had not been passed because the installation was not complete. It had not been tested with the lights on. The work would not be passed until the whole of the fittings in the house were finished.

Mr. Duncan submitted that the whole house was a unit, and the work should be tested and passed by the Urban Council before payment. That was a condition of receiving payment, and unless the test was passed defendant was justified in withholding payment.

Mr. Preedy said it was never a condition of contract that plaintiff should get the installation passed. All plaintiff had to do was to get the work done in accordance with the Council's rules.

His Honour: I think that is so. He has performed his contract so far as it could be done.

A verdict was given for the amount claimed, with costs.

BUSINESS NOTES.

Consular Notes.—HONG-KONG.—The American Consul reports that the matter of extending trade in the Hong-Kong field and in the Far East generally at the present time hinges more upon the results of the war in Europe than on any change in the normal relations of the United States to China, Japan, Indo-China, or any other portion of the Hong-Kong field. American opportunities depend largely upon the resumption of normal conditions in China. With the advent of normal demand for foreign goods for use in China, there will be a demand for American goods in many lines for the reason that the United States at the present time is almost the only country in a position to supply such goods. Japanese manufacturers are already in the field with Japanese substitutes for nearly all lines of German goods. While British manufacturers are suffering many disadvantages becauses of the war, they are still getting not only nearly all the business they have had heretofore which is now to be had, but also a large proportion of that business heretofore belonging to countries at war with Great Britain which is now available. In some respects attention should be paid more to the future than to the present, for trade at present is in comparatively small tune.

CHINA.—The American Consul at Hong-Kong reports that the question of the construction of a tramway system in Canton is being taken up anew by the provincial authorities, and plans for a line connecting the stations of the Canton and Hankow Railway and the Kowloon-Canton Railway, and running through a populous portion of the city, have been drawn up and have been forwarded to the authorities in Peking for approval.

The proposed line is projected by Gen. Lung, military governor of Kwangtung Province, in connection with Chinese capitalists in Hong-Kong, and the plans call for the construction of a little less than six miles of street railway along a route which will permit of the use of a considerable portion of the old wall of Canton. It is proposed to construct the line by means of a company for which the provincial government will furnish half the funds.

Plans for the rolling stock are not yet complete, but the general idea seems to be to buy motors and steel parts of cars abroad, completing the cars in Canton or Hong-Kong, present high freight rates rendering the purchase of complete cars abroad at this time a matter of difficulty. It is thought that the line as projected can be started with an initial outlay of about $100,000 gold. The practical management of the enterprise at present is in the control of Mr. Chin Gee Hee, president the Sunning Railway Co., who is working upon it in consultation with Gen. Lung.

The American Commercial Attaché at Peking reports that he recently had an interview with Mr. Chow Wan Pang, Director of Posts and Telegraphs in the Ministry of Communications, and was informed, relative to the contemplated telephone system for the Wuhan cities (Wuchang, Hankow and Hanyang), that the specifications have been completed, and that after their inspection by expert authorities tenders will be called for in the Peking and Shanghai papers. It seems that arrangements will undoubtedly be perfected whereby the telephone systems for the various foreign concessions in Hankow will be taken over by the Chinese Telephone Administration, as well as the German system now in use in Hankow city, and the general system substituted therefor. Although it has not been definitely decided how many telephones the new system will provide for, 2,000 or 3,000 will probably be called for, and arrangements will be made whereby the system will allow of an expansion up to 10,000 instruments. Hankow is a very important centre in China, and will probably occupy a position in that country analogous to that of Chicago in the United States. The combined population of the three Wuhan cities is conservatively estimated at 1,000,000. It appears that the main consideration in regard to this installation is the question of credit; hence it would be well for manufacturers to be prepared to make overtures in this direction with any bid for the business.

RUSSIA.—The American Consul at Moscow reports that American electrical works are in a position to make very favourable propositions in electrical supplies, of which there is a great scarcity on the Russian market. The only difficulty consists in the size of the order, the minimum stated by the American manufacturers being so large that the Russian purchasers are unable to distribute the amount.

Catalogues and Lists.—E. H. Freeman Electric Co., Trenton, N.J., U.S.A.—Price list of "guaranteed wiring devices" as used in the United States.

Trenton Porcelain Co., Trenton, N.J.—Price list of standard porcelain insulators, knobs, cleats, switch bases, &c.

Graphite Lubricating Co., Bound Brook, N.J., U.S.A.—Booklet describing oil-less bearings with graphite lining, trolley-wheel bushings, &c.

British Insulated & Helsby Cables, Ltd., Helsby.—Pamphlet describing the Helsby patent "Power" type condensers for use on A.C. power circuits, and explaining their use for the improvement of power factor.

Frank W. Morse, Boston, Mass., U.S.A.—Price list of electric lighting appliances, fittings, reflectors, connectors, &c.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Binder containing autumn catalogues of electric heating and cooking appliances, including the electric fire cone and cone fires, bar fires, cooking disks, boiling plates, grills, breakfast cookers, ovens, &c.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Folder describing oil-immersed drum-type starters.

Messrs. Fredk. Hodgson & Co., 24, Queen Victoria Street, E.C.—Price list of electric fans, D.C. and A.C., with oscillating movement, ceiling fans, portable fans, and a special line of cheap desk fans.

Dissolutions and Liquidations.—Adnil Electric Co., Ltd., Adnil Building, Artillery Lane, London, E.C.—A provisional order for the winding up of the above company was made upon the petition of a creditor, following on the decision of the Court of Appeal that, owing to the constitution and control of the company—the directors being resident, and the bulk of its share capital being held, in Germany—it can no longer effectively carry on its business. This order does not imply that the company will not be able to pay all its creditors in full, but the step was necessary in order to protect the assets. Under the order, Mr. J. H. Stephens has been appointed special manager pending the meeting of creditors, which will be held when the Courts re-open after the Long Vacation, and in this capacity he is carrying on the business for the beneficial realisation of the assets. He is retaining the services of Mr. Leach to assist him in the management of the business.

The business recently carried on in the name of Messrs. Marples & Leach, at 26-30, Artillery Lane, E.C., has been determined as from July 31st, 1915. Mr. Marples has joined the Swedish General Electric, Ltd., of Norfolk House, Cannon Street, E.C., where communications to him should be addressed. Mr. Leach is continuing in business at the above address until further notice.

Book Notices.—The *Wileroid* is the title of the first issue of a new magazine produced by members of the Switchboard Department of the British Thomson-Houston Co., Ltd., Willesden; it contains a variety of articles and notes, rhymes, sketches, and other interesting items, which do credit to the literary and artistic abilities of the authors. A whole page is occupied by the Roll of Honour, containing the names of men who have left Willesden to join the Colours, about 150 in number. Naturally, there is an under-current of war affairs running through the contents. A view of the annual staff outing at Sunbury shows that the party enjoyed fine weather (it was in June). A search through the magazine has failed to elucidate the derivation of its cryptic title.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI, Part 4. July, 1915. Newcastle-on-Tyne. The Institution.

Trade Announcement.—Messrs. J. W. Buck and Co. have started business in wholesale electrical supplies at 39, Victoria Street, London, S.W. They hold an agency for the Stella Conduit Co., Ltd., of Bilston. 'Phone: "Victoria 344."

France.—An agent wishes to represent a United Kingdom manufacturer of electrical apparatus; name and address can be obtained from the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Bankruptcy Proceedings.—J. G. M. Hilton, electrical engineer, Birmingham.—Trustee (A. S. Cully, Official Receiver, 191, Corporation Street, Birmingham) released July 15th, 1915.

For Sale.—The City and South London Railway Co. invite tenders for purchase of the generating and sub-station plant now at the Angel and London Bridge stations. Particulars are given in our advertisement pages.

LIGHTING and POWER NOTES.

Aberystwyth.—Restricted Lighting.—The T.C. has accepted from the E.L. Co. a rebate of £80 from the public lighting accounts for five months, owing to restricted lighting.

Argentina.—Recently Messrs. A. Rafael Langone & Co. made an offer to the municipality of Buenos Ayres to undertake the entire electric lighting of the city at 20 per cent. less than the present prices of the service, utilising a new secret system of their own, the nature of which they would not reveal. They offered to contract for the lighting service for a period of 12 years, making over all their installations to the municipality on the expiry of the period. Before taking the proposal into consideration, the municipal authorities required the proposers to present their application on stamped paper (value $500 m/n.) in terms of the regulations governing such matters. The proposers protested that this requirement did not apply to their case. The legal advisers of the city consider that the municipality is not in a legal position to consider the proposal referred to, having regard to its existing lighting contracts.

The Municipal authorities of Campana and the administrators of the local electric lighting company are in conflict. The Municipality refused to pay its June lighting bill unless the company (Compania Industrial Holando-Americano) first paid a sum of $3,000 claimed by the Municipality as fines. The manager of the company announced that unless the Municipality paid, the light would be cut off, and when this took place the Mayor took possession of the power station, at the head of the local police, and found electricians who were able to turn on the supply after half-an-hour's delay.

The Electrical Department of the Government of the Province of Buenos Ayres has reported favourably upon the application recently made by Senor Marcelino S. Romero for the electrical concession at Punta Alta (Bahia Blanca).—*Review of the River Plate.*

Ashton-under-Lyne.—The Electricity Committee has decided that as soon as the existing shop lantern agreements terminate, the charge per lamp be as follows:—£2 per annum for the upkeep and 1d. per hour burning for current.

Australia.—The Auburn Municipal Council has decided to light the municipality by electricity. After conferences with adjoining Councils and the Sydney city electrical engineer, the Council has adopted an agreement which provides for a term of 10 years, with the option of renewal. The Lidcombe and Granville Councils are also considering the question of electric lighting. —*Sydney Evening News.*

The Premier, in outlining the Metropolitan Council (Greater Melbourne) Bill (second reading) in the Legislative Assembly, stated that the electricity supply was practically confined to the City Council, which supplies three other Municipal Councils, the Melbourne Electric Supply Co., and the North Melbourne Electric Tramway and Lighting Co. The new Council was eventually to be the sole electrical supplier in the metropolis, and would have power to take over all concerns now operating. The amount of compensation, if not agreed, would be settled by arbitration.

Aylesbury.—Hospital Lighting.—The U.D.C. has decided to supply current to the Royal Bucks Hospital, which has its own battery, on a special rate.

The Electricity Committee has been asked to consider the possibility of terminating the agreement with the consulting engineers in view of the compulsory area having been cabled.

Barnsley.—Loan Sanction.—The L.G.B. has sanctioned the Council's application for a loan of £15,220 for extensions of plant at the electricity works.

Basingstoke.—The T.C. has decided to extend the area of supply to various parts of the town where there are prospective customers.

Burnley.—Price Increase.—The Corporation has decided that following the increased price of coal, the charges for electricity will be:—In the borough: for lighting, 3½d. per unit; heating, 1½d. per unit; power, the present prices, plus 5 per cent. In Reedley Hallows: For lighting, 4½d. per unit; heating, 2½d.; power, the present prices, plus 5 per cent., with the usual discount for prompt payments.

Callan (Co. Kilkenny).—Workhouse Lighting.—The Callan Co-operative E.L. Society has offered to light the workhouse electrically at a cost of about £60. The yearly cost of the light is estimated at £45, with electricity supplied at 6d. per unit for lighting, and 2d. for power and heating. The B. of G. is to consider the matter at a future meeting.

Canada.—According to the *Electrical World* the Ontario Hydro-Electric Commission will submit to the Ontario Government plans providing for the development at Niagara Falls and from the spillways of the New Welland Canal of 250,000 H.P., and for an immediate development of 100,000 H.P., a work that will entail a capital expenditure of approximately $10,000,000 and require three years to complete.

Under the treaty between Great Britain and the United States governing the amount of water that can be taken at Niagara Falls, there remain about 6,600 cb. ft. of water per second available on the Canadian side. The plans of the engineers of the Hydro-Electric Commission contemplate the use of this water. It is understood that the Commission will erect a plant at Chippawa Creek that will enable power to be developed on both the Niagara River and the Welland Canal spillways. The Commission also purposes to go to the Minister of Railways and Canals and ask for the water-powers that were promised on the Trent Canal, from which can be developed from 15,000 H.P. to 20,000 H.P., unless satisfactory arrangements can be made with the interests now controlling the power in the Trent Valley.

Dundee.—It was announced at a recent meeting of the Committee that the electricity department is not in a position to undertake new lighting or power installations at the present moment unless for Government work.

Easington (Co. Durham).—Proposed Refuse Destructor.—The R.D.C. has decided to obtain information regarding the provision of a refuse destructor, with a view to one being installed in the district after the war.

Glasgow.—Year's Working.—With further reference to the annual report on the year's working of the electricity department, of which some financial particulars were given on page 141, the total output generated was 104,227,424 units, from Port Dundas, Pollokshaws, Kelvinside, Govan, and Partick stations, and the figures include over a million units purchased

from the tramways department. The total quantity sold was 88,834,270 units, as against 77,020,871 units in the previous year, and included 19,849,725 units for private lighting, 65,718,795 units for power and heating, 2,756,400 units for public lighting, and 359,075 contract units. The consumers numbered 32,030, and the public lamps 1,440 arc and 390 metal-filament lamps. The total number of motors in use, on the mains, was 10,681, of 77,305 H.P., taking 64¾ million units; the previous year's figures were 9,638 motors, of 66,947 H.P., consuming 53¼ million units. The total connected consumers' load to May 31st last was 101,048 KW.; the maximum station load was 39,750 KW.; and the units consumed by private customers per lamp fixed averaged out month by month was 26·7. The plant capacity of the Port Dundas, Pollokshaws, Govan and Partick stations was 72,000 H.P. A Maclaurin gas producer is being erected at Port Dundas station, to test the gas firing of boilers and to experiment with a view to obtaining a smokeless fuel as a by-product of the gas process. A 1,000 KW. rotary converter is now in use at Govan station, where another small engine-driven set has been disposed of. A 1,000-KW. rotary is also being installed at Partick; at this station the burning of street refuse has been discontinued and the crushing plant is now dealing successfully with this problem; 300 KW. of steam plant and the storage battery have been sold during the year. A second 500-KW. rotary converter is to be installed at Kelvinside station. Consumers' sub-stations now number 27; the largest addition was in the Fairfield Co.'s premises, where the plant capacity is 4,200 KW., the change-over to the Corporation's supply being almost complete. There are now four sub-stations at Messrs. Beardmore's Parkhead Works; when all the plant is running in these consumers' sub-stations it will amount to 15,000 KW. At the new Dalmarnock station, the foundations are nearly completed, but nothing further will be done until after the war.

Gravesend.—The T.C. has authorised a Sub-Committee to complete negotiations with Henley's Telegraph Works Co., Ltd., and the Empire Portland Cement Co. for supplies of current for power purposes. No future contracts for power supply are to be entered into without a clause making the price of current dependent upon the rise and fall in the price of coal.

Hetton-le-Hole.—Street Lighting.—The U.D.C. has accepted the offer of the Tramways Co. to undertake the public lighting of the district by electricity for another year as an experiment, with a view to a permanent agreement being entered into. Owing to the reduced number of lamps used to comply with the lighting order, the company's price is to be increased by 3s. per lamp.

Hitchin.—Street Lighting.—The U.D.C. has accepted the offer of the Electric Supply Corporation, Ltd., for two electric lamps on trial for public lighting, at 2d. per unit for the all-night lamp, and 2½d. per unit for the lamp alight until 11.30 p.m.

Hong-Kong.—The China Light and Power Co., Ltd., Kowloon, has decided to adopt a more progressive policy than formerly, and a very serious effort is to be made to develop the outlying districts and capture the rapidly increasing power demand. With this object in view the company is being reorganised and the station extended and modernised. The manager's salary is being considerably increased. Mr. C. N. M. Hamilton (manager) has resigned, and the company is in negotiation with a well-known engineer to fill his position.

Hove.—Year's Working.—The first accounts of the electricity undertaking, which has now been in the Council's possession for a year, since being taken over, show a net profit of £3,023, which is considerably in excess of the expected surplus. Reductions in price and meter rents represented in the aggregate some £1,157 for the year. The Aldrington undertaking made a net deficit of £148; this undertaking has now been merged into the Hove supply.

Ipswich.—Loan Application.—The T.C. has applied to the L.G.B. for an additional loan of £8,760, to cover the cost of sub-stations and materials, the Board having intimated that it would sanction the amount on receipt of a formal resolution of the Council, when the actual cost was ascertained.

Kingston-on-Thames.—Year's Working.—During the last financial year the Corporation electricity department sold 1,162,000 units, as compared with 1,242,000 units in the previous year; the consumers numbered 1,789, an increase of 113. The total revenue was £15,273, as compared with £15,416 in 1913-14, and the gross profit £6,684, about £50 in excess of the previous year, despite the falling off in revenue. A decrease in works costs resulted from the more extended use of the Diesel plant, the steam plant being only run on the peak loads. Steam plant generated 306,200 units with a fuel cost of 1·8d. per unit, as compared with 855,801 units by Diesel plant, at a cost of ·424d. per unit. Unfortunately, extra expenditure was incurred during the year in interest, repayments of loans, income-tax, &c., totalling £1,072, and after meeting all charges, the deficit on the year's working was £1,295, as against a deficit of £721 in the previous year.

The Council has decided on a further increase in prices all round. The report led to a critical discussion by the Council, in the course of which Councillar Hall moved a resolution, which another Councillor declared to be tantamount to a vote of censure on the electrical engineer and the Lighting Committee, and, despite a warm defence by Alderman Lyne, this was carried by 13 votes to 11; the Alderman remarking that after such a resolution, which was a serious reflection on the Lighting Committee, he could not carry on. The minutes of the E.L. Committee and report were approved.

London.—Marylebone.—At a recent meeting of the B.C. the annual report of the electricity department was presented. From this it appears that for the first time a decreased output occurred on the year's working, 15,926,167 units being sold, as against 17,038,516 in the preceding year; the gross income shows a corresponding decrease, from £176,716 to £168,854; this setback is entirely due to lighting restrictions. Altogether, it was considered that the net revenue had suffered, through circumstances beyond the Committee's control, to the extent of £15,400. As a final result, a debit balance of £7,057 occurred on the year, as against a profit of £4,525 in the previous year. Ald. Duncan Watson, chairman of the E.S. Committee, in moving the adoption of the report, pointed out that when he took up his position after the commencement of the war, it was obvious that there must be a deficit on the year's working. He outlined the difficulties met with, including a proposed increase in assessment, which had fallen through, pointing out that had it not been for loss of revenue, increased expenses, &c., even assuming no increase over 1913-14, intead of a debit of £7,057, they would have had a credit balance amounting to £12,617. After a discussion, in which it was mentioned that the undertaking was now paying £15,000 a year in rates and taxes, the report, &c., was adopted.

Market Drayton.—Street Lighting.—The U.D.C. has accepted the offer from the E.L. Co. for connecting the street lamp standards with the mains, and fitting with bracket, service boxes, cable jointing, trenching and re-instatement, at £2 10s. per lamp.

Meltham.—Proposed E.L.—The Council has appointed a deputation to wait upon the Electricity Committee of the Huddersfield Corporation with a view to securing a supply of electricity to the Meltham area.

Navan.—Workhouse Lighting.—At a recent meeting of the B. of G. it was stated that, as compared with gas lighting, £75 had been saved in five years by adopting electric light.

Nottingham.—According to the *Nottingham Daily Express*, negotiations have been taking place between the Corporation and Messrs. Cammell, Laird & Co., with a view to the latter erecting works on a 12-acre site. Apparently these have resulted successfully, and it is stated that the Corporation has undertaken, on behalf of the firm, to construct a special electrical station on the site.

Plymouth.—The Electricity Committee has recommended that the borough electrical engineer be instructed to report upon the reorganisation of the staffs of the electricity undertakings, consequent upon the resignation of the engineer of the Newport Street works.

Southend.—The Electric Lighting Committee has decided to defer the laying of a branch main to the Eastern Valley sewage pumping station.

In view of the postponement of the erection of the Thorpe Bay sub-station, the town clerk has been directed to negotiate for the retention of the site already agreed upon for this purpose.

Street.—Street Lighting.—The U.D.C. has been informed that the public lighting scheme will be completed early in September.

Stretford.—Price Increase.—The Trafford Power and Light Supply (1902), Ltd., has informed the U.D.C. that the charges for electricity are to be raised 10 per cent. in the case of current for lighting, and 15 per cent. in the case of current for power purposes.

Surbiton.—E.L. Transfer.—The U.D.C. has completed the agreement for the transfer of the electricity undertaking to Messrs. Callender's Cable and Construction Co., Ltd.; the clerk has been instructed to take steps to obtain the sanction of the B. of T. to the transfer.

Tunbridge Wells.—Annual Report.—The report of the borough electrical engineer, on the year's working to March last, shows that greater progress was made than in the previous year. The revenue was £18,613, and the gross profit £9,629, while the net profit was £3,157, as compared with £2,165 in 1914 and £1,111 in 1913. The units sold numbered 1,334,729 as against 1,126,622 in 1914; the load factor was 16·8 per cent., maximum load 907 KW., generating plant capacity 1,600 KW., and connected load 3,484 KW. During the year a 300-KW. turbine plant was installed, which carries the day load, the steam consumption according to test figures having dropped from 28 to 21 lb. per KW.-hour. The full benefit of this turbine will be felt in the present year. Underfeed stokers have been introduced on three boilers, the coal bunkers extended and, in particular, a large new coal store and wharf at the Medway sidings has been opened, in which some 700 tons of coal have been stored. Over 1,500 consumers are now connected to the mains.

U.S.A.—Electricity in Sheep Farming.—According to the *Electrical World*, the great sheep ranches in the stock-raising regions of Oregon are large consumers of electricity for light and power. Central station energy is used for pumping in the irrigation districts and for chopping grain for stock feed in the winter. In one of the large stock-raising farms electricity has been put to a novel use for the winter fattening of sheep. The sheep pens are wired and the electric light is turned on during the winter months from 4 p.m. to 9 p.m. Under this artificial illumination the sheep continue to feed until the lights are extinguished. At 4 a.m. the lamps are then again turned on and burn until daylight, and again the sheep feed. In this way the sheep are made to feed during the equivalent of a long summer day, and thus, despite the winter season, are brought quickly to the condition for marketing.

TRAMWAY and RAILWAY NOTES.

Aberdeen.— Proposed Tramway Purchase. — After considering the question of the purchase of the suburban tramway system, the Corporation Tramways Committee decided to ask Mr. Dalrymple, manager of the Glasgow Corporation Tramways, to visit the city to consult with the Advisory Committee.

Accrington.—At a meeting of the T.C. last week, Alderman T. E. Higham said the Tramways and Electricity Committee had resorted to the employment of female tram conductors because it could not get men who were not of military age to fill the positions. They were receiving exactly the same remuneration for the same work that the men had.

Australia.—In his second reading speech on the Greater Melbourne Bill, before the Legislative Assembly, the Premier indicated that the Council would assume control of all tramways in the enlarged area. Undertakings controlled by municipal trusts would simply be taken over as going concerns; the lease of the Melbourne Tramway and Omnibus Co., which controls all the lines terminating in or running through the city, expires on July 1st, 1916, and the Council would be empowered to acquire by agreement, or compulsorily, the undertaking, so that the company would go out of business after that date. Power will be given to shorten the life of the Melbourne Tramways Trust, if desirable.

Birtley. — Suggested Tramway Extension. — The Parish Council has decided to ask the Gateshead and District Tramways Co. to extend its tramways from Low Fell to Birtley, as large permanent engineering works are to be erected in the town.

Hove.—Railless Traction.—The T.C. has decided to dismantle the electrical overhead equipment which was installed in part of the main thoroughfare about a year ago as an experiment, to determine the system to be adopted in establishing the joint service of electric railless 'buses to be put on the roads in Brighton and Hove. In thus removing the posts and wires, the local authorities of Hove will have to pay about £600 to the company which contracted to erect the plant, but this payment will be taken into account should circumstances in the future permit of a revival of the scheme. The two towns have mutually agreed to defer any further progress with the undertaking until "six months after the war."—*Daily Telegraph.*

L. & S.W. Railway Electrification.—According to the daily Press, the current is to be switched on to the Kingston loop line in a few days' time. This line includes all the stations between Waterloo, Clapham Junction and Kingston *viâ* Wimbledon, and back to the Junction *viâ* Richmond and Barnes. Various other sections will be completed in quick succession, to Twickenham, Shepperton, Hampton Court and Claygate, and, in all, 140 single track miles will be electrified. The trains will consist of three-coach units, run singly or in duplicate, according to traffic requirements.

Oldham.—War Bonus.—The local Tramway Workers' Union has again asked the Tramways Committee to consider an application for a war bonus for its members. A previous application was allowed to drop after the men's representatives had interviewed the general manager, and also in consequence of the manner in which the Corporation was treating employés who had gone on active service. The renewal of the demand is due to the fact that the General Labourers' Union is making a demand for a war bonus on the Gas Committee; the Tramways Committee has decided to leave the matter with the Special Committee that is dealing with the labourers' application.

Sheffield.—Female Labour.—It was stated at the last meeting of the City Council that about 180 women conductors were now employed on the tramcars. It was not the general policy of the Tramway Committee to employ married women, but a number of wives of soldiers serving at the Front had been engaged

TELEGRAPH and TELEPHONE NOTES.

Chorley.—The Buildings Sub-Committee of the Chorley Board of Guardians has been authorised to prepare a scheme for the installation of intercommunication telephones to link up the various departments, and to consult an expert electrician.

Eccles.—An outbreak of fire occurred last week at the Eccles Telephone Exchange in Monton Road, and the Corporation fire brigade was called out. The damage caused was only slight.

Italy.—The police have seized at Milan, a wireless apparatus belonging to Signor Olivi, an engineer, and have lodged information against him and his three assistants.

Japan.—It is reported from Tokio that on July 7th wireless communication was successfully inaugurated between the new station at Funabashi, near Yokohama, and the Hawaiian Islands. Messages by wireless telegraphy between Japan and the United States will be regularly accepted in the near future. The distance between Funabashi and Honolulu is about 4,000 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters, for the P.M.G. See "Official Notices" July 23rd.

Brisbane.—October 6th. Tinned-copper wire, porcelain pothead insulators, for the P.M.G. See "Official Notices" to-day.

Perth.—September 29th. Telephone switchboard parts, for the P.M.G. See "Official Notices" July 30th.

Sydney.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

September 23rd. Condensers, galvanometers, relays, and sounders, also incandescent electric lamps, for the P.M.G.'s Dept. See "Official Notices" August 13th.

October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

Melbourne.—September 8th. Transformers and relays for point indication for automatic signalling (Contract No. 28,918), and electric point and lock detectors (Contract No. 28,951), for a period of five years, for the Victorian Railway Commissioners.

September 29th. Fuse blocks (complete and spare porcelain bases and fuse clips), for the Victorian Railway Commissioners. Particulars at the Contractors' Room, Spencer Street.

Hawthorn.—November 30th. Refuse destructor plant, for the Hawthorn-Malvern-Camberwell and Kew Destructor Trust. Specification from the Trust Engineer's Office, Town Hall.

Aylesbury.—Electric light installation, Town Hall, for the U.D.C. Mr. W. A. Turnbull, electricity works (returnable deposit of 10s.).

Bristol.—August 23rd. Corporation. One 6,000-kw. three-phase steam turbo-alternator with condensing plant. See "Official Notices" July 23rd.

London. — H.M. Office of Works. — August 20th. Enamelled electric conduit and fittings. See "Official Notices" August 13th.

L.C.C.—August 23rd. Installation (74 wiring points, 93 lighting points) at Winchester Street Elementary School, Pentonville Road, N. See "Official Notices" August 13th.

New Zealand.—September 1st. Public Service Stores Tender Board. Supply and delivery of (1) 92 miles of air-space, paper insulated, lead-covered telephone cable, and (2) 100 miles of insulated and braided wire. Controller of Stores, Post and Telegraph Department, Wellington.*

Portsmouth.—August 31st. Corporation. Six months' supply of stores, for the Tramway Committee. See "Official Notices" to-day.

Rochdale.—Electricity Committee. Supply and delivery of static transformers for a period of 12 months. Mr. C. C. Atchison, electricity works, Dane Street.

Shanghai.—September 24th. Municipal Council. One turbo-generator, 5,000 kw., and one or two of 10,000 kw., complete with condensing plant, &c. See "Official Notices" to-day.

South Africa.—Johannesburg.—September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear,

&c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.*

West Ham.—September 2nd. Three months' supply of electrical fittings, for the B. of G. of the West Ham Union. Forms of tender from the Clerk, Union Road, Leytonstone, N.E.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Government Contracts.—List of new contracts for July, 1915 :—

War Office.

Asbestos.—Bell's United Asbestos Co., Ltd.
Cables and wire.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.; A. Green, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; Liverpool Electric Cable Co., Ltd.; Midland Electric Wire Co., Ltd.; Siemens Bros. & Co., Ltd.; Ward and Goldstone.
Generating sets (parts).—Austin Motor Co. (1914), Ltd.
Electric lamps.—Crypelco, Ltd.; General Electric Co., Ltd.; Pope's Elec. Lamp Co., Ltd.; Yorkshire Incandescent Electric Lamp Co., Ltd.
Telephone sets.—Western Electric Co., Ltd.
Brass and copper wire.—T. Bolton & Sons, Ltd.; C. Clifford & Sons, Ltd.; R. Johnson & Nephew, Ltd.; D. F. Taylor & Co., Ltd.
Works services.—Electric light installation, St. Anthony: Drake and Gorham, Ltd. Electric light installation, Devonport: Henley's Telegraph Works Co., Ltd. Electric wiring at Salisbury Camp: Edmundson's Electricity Corporation, Ltd.; A. V. Gifkins & Co. Electric lifts, Whalley: W. J. Furse & Co., Ltd. Electric light and power, Park Royal, Acton: Mann, Egerton & Co., Ltd.

Crown Agents for the Colonies.

Submarine cables.—Siemens Bros. & Co., Ltd.

India Office Store Department.

Aeroplane transmitters.—Marconi's Wireless Telegraph Co.
Cells.—Siemens Bros. & Co.
Copper wire.—F. Smith & Co.; Shropshire Iron Co.
Insulator cups.—Taylor, Tunnicliff & Co; Bullers, Ltd.
Wire.—Callender's Cable & Construction Co.

H.M. Office of Works.

Electrical work, Eastcote Alien Camp.—Pinching & Walton.

Post Office.

Telegraphic apparatus.—Creed, Bille & Co., Ltd.; Gell's Telegraphic Appliances Syndicate, Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; B.I. & Helsby Cables, Ltd.; Peel-Conner Telephone Works, Ltd.
Telephone cable.—Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Telephone lamps.—A. C. Cosser, Ltd.
Copper.—F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).
Alterations to batteries, Central Telephone Exchange, London, E.C.—The Chloride Electrical Storage Co., Ltd.

Heywood.—The T.C. has accepted the tender of Messrs. Blakeley & Wild for a temporary superstructure building at the electricity works.

Sunderland.—The T.C. has accepted the following tenders on behalf of the Electricity and Lighting Committee :—

Babcock and Wilcox.—Links for chain-grate stoker.
India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.—Brush-holders for motor-generator.
W. G. Farrow & Co.—Street box frames and covers.
Steel & Co.—Cast-iron box frames and covers, gun-metal clamping blocks, mild-steel bolts and cubicle covers.
B.I. & Helsby Cables, Ltd.—Cable racks and wood cleats.
South Durham Steel & Iron Co.—288 ft. mild-steel angle bar.

REVIEWS.

Wiring of Finished Buildings. By Terrell Croft. London: Hill Publishing Co. Price 8s. 4d. net.

This book is American—written by an American principally for Americans. The statement implies that it has limitations when viewed from the English standpoint, as will be mentioned later, but it also means that it has a refreshing liveliness which is not usually found in English technical books.

In its general arrangement the book leaves little to be desired. Every paragraph, table and illustration is numbered, and references are given fully and accurately. The explanations, once the differences between American descriptions and ours have been appreciated, are clear and concise, and the illustrations are particularly good. Every one appears to have been made specially for the book, and there are none of the irritating reproductions of stock catalogue illustrations that are usually found in similar English books. Also, no space is occupied in valueless reprints of standard wiring rules.

The result of all this is that in well under 300 pages Mr. Croft has managed to compress what might well have formed the basis of two or three books.

The first portion of the book—about the first six chapters, occupying some 100 pages—deals with the business of the supply authority in obtaining new customers, and the details given by Mr. Croft of American efforts in this direction would surely make many of our publicity experts ashamed of their past records. He treats of all sides of the subject. For example, the relative value of different forms of advertising—posters, circulars, shop window displays, "soliciting" (American for canvassing), and so forth—is discussed fully, and actual results obtained in various towns are scheduled out in detail. Mr. Croft is evidently a believer (and he produces plenty of evidence in support) in the value of an advertisement offering to install wiring on special terms for a limited period on some system of free wiring or of gradual payment. He is, however, emphatic that it is best to carry out the work through a contractor. To quote one paragraph only :—

"It appears to be the general opinion among those best informed that the most effective system of handling finished-building wiring is (1) for the central station to agree, with the local contractors' association or with a group of contractors, upon a standardised price schedule (see par. 75) for wiring; (2) the central station solicits the wiring business on the basis of the standardised schedule assuming all solicitation and advertising expense; (3) the central station apportions equitably the business thus obtained among the contractors, with whom it is co-operating; (4) the central station pays the contractor the standardised price upon the completion and acceptance of the job; and (5) the central station assumes the account, as hereinbefore explained, and receives the payments for it on the instalment plan, if the consumer so desires. Experience has shown that business can be obtained at prices that are sufficiently high as to allow a fair profit for the contractor."

The same general view is repeated in many other places, and the policy of various supply authorities is quoted time after time to the same effect. This is decidedly interesting in comparison with the efforts of the municipal supply authorities on this side to carry out such work themselves.

In this section, also, the question of cost is discussed very fully, and various systems of charging for free wiring installations are investigated. The actual figures are difficult to check as conditions are so different; it would appear that the American wireman gets about twice the rate per hour paid to the English wireman, but he also appears to get through a very much greater amount of work—which one can easily believe to be possible.

The next chapter, of between 40 and 50 pages, contains about the same amount of information as most English books on wiring work in houses, if allowance is made for the mass of unnecessary detail usually repeated in such books which would certainly be known to anyone who would read them. The subject is considered from the American standpoint, which is evidently very different to ours. There is a large amount of information useful to wiremen here, but, on the other hand, much attention is given to such systems as wiring in flexible metallic conduit and "knob and tube" wiring (or, in English, wiring on porcelain insulators), which are scarcely used here at all for house wiring. Wiring on insulators between floors in wood-frame buildings appears to be a regular practice in America, but there are evidently carefully considered regulations (the National Code) that are enforced strictly by the Board of Underwriters. One cannot help a mental comparison with the system in force here which allows ridiculously bad work to go into house after house due to the entire absence of any supervision of cheap wiring work. The only jobs supervised here appear to be those where supervision is least likely to be required.

The remaining chapters of the book are mainly concerned with the actual carrying out of the wiring work, and might, again, easily form a separate book. Indeed, a reprint of certain sections of these chapters would form a most valuable book for wiremen which many firms would be glad to distribute to their men if it were available in a cheap form. The hints on making special tools for certain work, on fishing for wires through ceilings and down walls, on removing floor boards and base boards (skirtings) with a minimum of damage, and so forth, would be of extreme interest to many workmen to whom the earlier part of the book would scarcely appeal at all. Such a reprint might perhaps be re-written for English workmen, as a few sections would not interest them, but only very little alteration would need to be made. This side of the subject also is treated very exhaustively as, in addition to the suggestions as to tools, etc., already referred to, the general layout of typical installations is discussed, including such points as the adoption of roundabout routes to avoid damage or to get the advantages of an easier run for the wires.

Altogether, the book is full of valuable matter, and would be found of great interest, in whole or in part, to very many sections of the electrical industry, though principally, of course, it appeals to central station men, to contractors, and to wiremen of all grades.

Constant Voltage Transmission. By H. B. Dwight. London: Chapman & Hall, Ltd. Price 5s. 6d. net.

The disadvantages of a varying power factor in connection with long-distance transmission lines are fairly generally recognised. The objectionable features are, of course, considerable voltage variation at the receiving end of the line, and also the limitation of the amount of the energy current by the idle or so-called wattless current.

The purpose of the book under review is to urge that more synchronous motors be installed in alternating-current systems and that dependence be placed on them to secure the desirable result of controlling the line voltage at the opposite end to that of usual practice. The effect of synchronous condensers is so marked that in many cases they can be run idle and yet save several times their cost. A considerable amount of this apparatus is necessary and the excitation of the machines must be continually changed, and by thus varying the power factor the voltage drop in the transmission line is held at a constant value.

The first chapter is merely introductory to the subject, and the second one deals broadly with alternating-current transmission. We are pleased to see that the limiting of the transmitting voltage by the extraordinarily rapid increase in cost of the terminal apparatus is pointed out.

In Chapter III the synchronous motor is briefly described, while power factor control is treated in the succeeding chapter. Both are very short, but quite clear.

The history of this method of voltage control and its disadvantages as well as its advantages are set forth in succeeding chapters, which call for no remark except that they appear to be quite fair.

In Chapter XII we have what, in the opinion of the reviewer, is the most valuable part of the book—working methods of calculation. These are a combination of the use of imaginaries with graphics, and are practical and accurate. For engineering calculations, the results to be calculated should be selected because they are of the greatest commercial value, and not because they are the most easy to obtain. Numerical illustrations of the methods are given.

At the end of the book there is a collection of formulæ for transmission lines and an appendix giving the reactance of stranded conductors.

The impression left on the reviewer, after careful perusal, is that there is nothing very new about the book as a whole, but that it is an impartial and thoughtful attempt to show the benefits of this method of voltage control. The price appears to be rather high for a small-sized book of 115 pages only.—H.G.S.

The Year-book of Wireless Telegraphy and Telephony, 1915. London: Wireless Press, Ltd. Price 3s. 6d. net.

At this time, when wireless telegraphy is perforce in such eclipse so far as the private investigator is concerned, it gives us special pleasure to welcome the third edition of this monumental work as being something of live interest to be perused and criticised. The thickness of the volume has been quite considerably reduced, but not by reducing the matter presented, for, actually, 40 pages have been added to last year's total, and by careful editing the subjects dealt with have been increased, and the information already given revised and amplified. At the same time, it will be noticed that the price of the year-book has been slightly increased, at which no one can cavil.

All the regular features, on which we have now come to rely in this publication, are retained and brought up-to-date. The record of development in wireless telegraphy during 1914, which began with sufficient promise, naturally stops abruptly with the outbreak of war. It is, indeed, to be hoped that the many important developments thus dramatically interrupted may soon be continued. Wireless telegraphy laws and regulations, the international radiotelegraphic convention, and the section on safety of life at sea remain practically as in the last edition, and are sections of proven utility to all practical workers. So, too, are the laws and regulations of all countries, which occupy over 200 pages in their expression, and include the fateful orders which paralysed private wireless work last August.

The invaluable tables of land and ship stations occupy about thirty pages more than in last year's edition, and they have evidently been revised and amplified as fully as possible under the old headings (name, geographical position, call signal, range, company or ship, wave length, nature and hours of service and tariffs). We would again suggest, however, that it is wholly desirable to include, wherever possible, a note of the system employed and the sending power used.

Articles by specialists on various topics form a valuable feature of this as of previous issues, and of particular topical, as well as broader, interest are the papers on "Wireless and War at Sea," by A. Hurd; and on the "Influence of Wireless Telegraphy on Modern Strategy," by Col. F. N. Maude. In the former article, Mr. Hurd lays emphasis on the great changes wrought by improved systems of communicating intelligence and by steam power on naval warfare; he sketches the extraordinary development of wireless, but of the extent to which wireless telegraphy is actually used in modern naval warfare, and concerning its grave defect in disclosing the presence of ships to enemies in the neighbourhood, he says nothing. On the one point he could, naturally, say nothing even were he acquainted with the facts; but in the other matter, we fear Mr. Hurd has "let himself go" on the romantic possibilities of wireless without pointing out that its use was undoubtedly responsible for certain disasters in the Russo-Japanese war, and for many vessels falling victims to the *Emden* in the present campaign. We believe that time will show wireless telegraphy to have been used very cautiously by the winning side in this war. The fact that signalling is proceeding cannot be concealed, the direction of the signals can be located, at least, approximately, and codes are of very dubious value. In a peculiarly fascinating article on the effect of wireless on land strategy, Col. Maude justifies the surprising statement that it has no appreciable effect whatever!

A report is included of Prof. Fleming's address to the Wireless Society of London on the function of the earth in radiotelegraphy. This cannot be termed a "popular" exposition, and we are glad to note that the policy has been adopted of including some quite popular and some quite technical articles. It is disastrous to attempt to make every article appeal to layman and expert alike. Mr. H. J. Round writes on the Tyk system of wireless telephony, which was giving such promising results at the moment its development was interrupted by the war; and Dr. Eccles says about all that can be said concerning international wireless research in 1914. Articles of more popular interest are included on long-distance wireless services and wireless newspapers at sea, and a series of consecutive interest is formed by Mr. A. H. Morse on "Some Applications of Wireless Telegraphy"; Mr. R. C. K. Lempfert on "Application of Wireless Telegraphy to Meteorology"; and Mr. A. R. Hinks on "Wireless Telegraphy in Survey." Small additions have been made to the section on international time and weather signals, and the collection of formulæ and equations, glossary, dictionary, tables and data, list of patents and companies, biographical notices, and other miscellaneous information have been retained and brought up-to-date where necessary. By the care with which it is revised, by the wholesale substitution of fresh "current" material, and by its excellence throughout, this year-book is justly entitled to the high esteem in which it is now held by all associated with, or interested in, wireless telegraphy.

A School Electricity. By C. J. L. Wagstaff, M.A. Cambridge University Press. Price 5s. net.

It is very seldom that a "School Electricity" is sufficiently interesting to make it a pleasure to read it. Most school text-books are boring rather than interesting, and the writer who sets out to make such a book interesting by dint of joking and telling "funny stories" generally writes as boring a book as any of the rest. Mr. Wagstaff has, however, given us something in the nature of an oasis in the desert; he has written an interesting school text-book on electricity.

The author's success in this direction may be very largely attributed to the simplicity and clearness of his English diction. It is no exaggeration to say that the book is a good electricity book because it is written in good English. The same things have been said dozens of times before in the usual dry-as-dust text-book style; Mr. Wagstaff has taken these commonplace facts of electricity and magnetism and, by careful arrangement and choice of words, has endowed them with a freshness and attractiveness that cannot fail to appeal to every schoolboy who uses his book.

The book is based on a course of lessons given at Oundle School. These lessons were essentially practical and the experiments described were actually done, some in the laboratory by the boys, some in the class-room. The author believes very strongly in the early use of instruments (*e.g.*, ammeters and voltmeters) which give direct readings, in addition to those which only compare, and by a preliminary treatment of work and horse-power in the mechanics lessons he considers that it ought to be possible to talk about volts and watts quite early in the study of electricity. As a matter of fact, a boy would need very little preliminary teaching in mechanics to enable him to obtain a perfectly clear understanding of electrical pressure and energy from the chapter in this book on "The Volt," a chapter which is a unique example of the author's mastery over his subject and equal mastery over his phrases.

The order of treatment is much the same as in other elementary text-books. An introductory chapter on magnetism, followed by chapters on the ampere, the volt, and Ohm's law; then detailed treatment of resistance, primary cells and galvanometers. There is a short, but extremely good, chapter on temperature effects, and then the author passes on to consider the magnetic and electromagnetic effects leading up to the study of the dynamo and motor. Five chapters are then devoted to a fuller and quantitative treatment of magnetism, and the last five chapters to a similar treatment of electrostatics. The mathematical theorems of electrostatics are dealt with in two chapters—"Lines of Force" and "Mathematics of Electrostatics"—both of which are so extremely well written that few students will find any difficulty in mastering even this most difficult portion of the subject.

Each chapter is followed by a set of examples to which answers are given, and there is a set of miscellaneous examples at the end of the book, together with a number of photographs of filings diagrams. The book is splendidly printed and serviceably bound, and is the best school electricity that we know of.—P.H.S.K.

Engineers Wanted.—Professional men who have practical experience in the engineering trades, and are anxious to place their services at the disposal of the Government, are invited by the Board of Trade to consider the possibility of undertaking manual work in connection with the production of munitions of war. The great need of the moment, the Board says, is for skilled mechanics (turners, fitters, millwrights, &c.). Men whose training has included engineering workshop experience can now do valuable service by offering to do manual work at the usual rates of payment for such work. They will not displace any skilled workman; they will simply increase the army of those who by work at home help the armies abroad.

Professional men who wish to offer their services to this end should send full particulars of their qualifications to the "Engineers' War Service Register," Queen Anne's Chambers, Westminster, S.W.

HINTS TO APPLICANTS FOR SITUATIONS.

By ERNEST C. McKINNON, A.M.I.E.E.

The writer has frequently had occasion to insert advertisements for assistants in the Electrical Review and other engineering papers, and has always been astonished at the poor quality of the majority of the applications.

One advertisement will sometimes bring replies reaching into hundreds, and it is by no means an overestimate to say that over 75 per cent. of the replies are drawn up so poorly that they are simply a waste of time and money.

It may be that the advertisements are, to some extent, at fault in their wording or ambiguity—probably so in cases where one finds applicants wanting 30s. per week competing for the same vacancy with others asking £250 per annum. But this does not explain away the rambling, irrelevant, badly-written, incomplete letters which come to hand.

Some men appear to apply for practically every vacancy advertised—the writer during the past seven years has invariably observed an application from one man whose writing is weird, and who has another peculiarity, his age (stated) is decreasing.

One of his last applications may very well be taken as a model of how *not* to do it.

The advertisement stipulated that candidates should "state age, experience and salary required." Here was his reply:—

Dear Sir,—In reference to the Electrical Review advertisement, I beg to offer my services for the requirement. . . . Having been accustomed to electricity works and traction plants, running operations, &c. Also works and &c. Plant experiences, and installation works, etc.; working experiences thereof. Trusting in approval at a fair wage. My age is thirty-two; abstainer.

I remain,

Yours respectfully.

As an example of unnecessary and foolish padding, the following has been taken from an application rescued from the waste paper basket for the purpose of this note:—

I would prefer you to make an offer as to remuneration when you take up my references. In conclusion, I trust you will not consign my application to the waste-paper basket, but give me a fair chance.

Much may have been written already on the subject, but the waste with its accompanying disappointments still continues, and the writer trusts that the following notes will be helpful to numbers of the younger and less experienced applicants for posts of various classifications appearing each week in the Electrical Review "Wanted" columns.

The Application.

Remember that your application may be one of hundreds. It is almost certain that the employer will not even trouble to read a long rambling application closely written on both sides of the paper, but will give first consideration to those which are clear and concise.

Use paper quarto or foolscap size—avoid note paper, or paper ruled for cash.

Use ink—never write in black lead.

Although type-written applications receive more attention than badly-written ones, for certain positions where the applicant, if engaged, may be required to write daily reports, the employer will take handwriting into consideration.

Handwriting is undoubtedly a good index of character and habits. It may reveal, on the one hand, independence, boldness, assertiveness, self-confidence, physical strength, clearness of thought, intelligence, good education, neatness, and precision; and, on the other hand, weakness, hesitancy, nervousness, indecision, lack of training, irregular habits, slovenliness, irresponsibility, and illiterateness.

Write on one side of the paper only.

Leave a wide margin on the left hand side.

Divide the matter into distinct paragraphs.

Avoid scents, monograms, and letter headings.

Pin all separate sheets together.

For attractiveness the writer recommends that the application be enclosed in a cheap but neat stiff paper binder endorsed:—

Application of .....
For position as
.....
Box No. .....Electrical Review.

The first page should commence in letter form thus:—

Gentlemen,
Replying to your advertisement for.....
in the current number of the Electrical Review, Ref. No.....
I beg to tender my application as per particulars below.
Yours respectfully,
(Signed) Ordinary signature.

Then should follow in schedule form these *essential facts*:—

1. Name in full.
2. Address in full.
3. Age.
4. Single or married.
5. If married give details of family, but don't describe your children as encumbrances.
6. Wages or salary required.
7. Education summarised (for full details refer to page 2) — *For salaried men only.*
   - Elementary. Name of School. Period.
   - Secondary do. do. do.
   - Technical do. College. do.
   - University do. Period. Degrees taken.
8. Experience summarised (for full details refer to page 2 (and 3).
   - Give on this page list of previous employers.
   - ..... (apprenticeship)
   - .....
   - .....
   - ..... (present employers)
9. Mention if copy testimonials are attached, and if others can be obtained.
10. If free or engaged.
11. If engaged, what notice is required to present employers.

This may be followed by these *optional* facts—

If member of I.E.E.

Languages, and degree of proficiency.

Length of service with present or last employers, and reasons for leaving.

For Draughtsmen—Knowledge of metric system; use of slide rule.

For Juniors—If attending night classes.

Superfluous matter should be omitted, such as request for further particulars of job before applying, and statements *re* good time-keeping, being strong, willing and active.

Page 2 should be headed, "Application of .....," and should be a chronological record of the applicant's education and experience, giving the inclusive period on the left-hand side, followed by the name of the school, college, or firm.

Detail examination successes, degrees taken, and give a very brief statement of the work engaged upon, and experience gained at the different works and offices.

All subsequent sheets should be numbered consecutively, and headed, "Accompanying Application of....."

One sheet may be devoted to a list of references.

A separate sheet should be reserved for each copy testimonial.

The filling up of a schedule is often a pitfall to the simple-minded. Readers may have heard of the Irishman who stated in reply to an item in a schedule:—"State age of parents, if living." "Father, 106. Mother, 102." A friend with him pointed out that his parents were dead. "Yes," replied the Irishman, "but that would be their age, if living!"

Just in the same way a little consideration will show that the above schedule is drawn up to cover all sections. It is not *essential* for, say, a wireman to give particulars of his education, not because one does not expect a wireman to have a highly technical training, but because his *experience* would be the main ground for his selection.

The question of "Salary expected" is obviously a difficult one for applicants to decide, but the omission of a figure is liable to cause the summary rejection of the application.

There is the minimum for which you might take the job if details were known, and there is the awful feeling that you may be asking less than the employer is prepared to give.

A safe course would be to quote the "commencing wage or salary" at which you would be *willing* to take the position if engaged, relying on your energy, ability and industry to secure subsequent increases.

In reply to a recent advertisement, one candidate stipulated for the strange figure of £91 per annum.

Applicants should state a *weekly wage* if they expect to be engaged by the week, or a *yearly salary* for monthly or quarterly engagements.

Some people may query the insertion of "Details of family" among the essentials, and suggest that this should be in the "Optional" section; but if the information is

not given in the application, it is sure to be asked for at the interview. The employer will prefer a man without family ties for certain posts, but will regard family ties as a likely reason for a man settling down into certain other positions.

THE INTERVIEW.

If in due course you are lucky enough to be invited to attend at an appointed place at a fixed hour, a few suggestions may help applicants.

Bring with you all certificates and original testimonials.

Be punctual.

Be clean and tidy.

Be polite.

Don't be nervous or incoherent.

Don't be familiar.

Don't be garrulous (talkative).

Don't be disrespectful *re* your past employers.

Attend to Nature's requirements just before the interview.

Little details may attract the notice of the employer to your disadvantage. It is, therefore, wise to keep the appointment with an absence of stubble on cheek or chin, and be provided with clean collar and handkerchief, and possessing clean finger nails and clean teeth.

If a chronic smoker of cigarettes endeavour to remove the stains from your fingers.

If you have a meal just before the appointment avoid onions, kippers or other dishes with a lingering reminiscence.

Don't brace up your courage with stimulants; a belch of beer or a whiff of whisky may hash your chance.

Don't come in chewing a cachou, to sweeten your breath; it creates suspicion.

Avoid perfumes, a waxed moustache and a display of jewelry.

Don't carry a cane, and *do* take your hat off.

This last point is a rock on which many applicants founder.

Familiarity is almost certain to be resented.

Talkativeness will be regarded unfavourably, especially if this takes the form of confidences regarding your grievances, or the shortcomings of your last employers.

Try to avoid fidgetiness, which includes feet-shuffling, playing with your hat, dropping pencils, &c.

Raise your voice to a tone which you can perceive is effective, and talk clearly. If the questions put to you have to be repeated, time is wasted—another man is probably waiting outside—you are therefore losing ground.

Don't let your gaze wander round the room.

Look your future employer in the face while he addresses you, and during your replies.

In anticipation that your railway fare and reasonable expenses incurred by the visit will be refunded to you, come prepared with a slip detailing the items.

NOTES.

Magnetisation by Rotation.—In a letter to *Science*, Prof. S. J. Barnett, of the Ohio State University, says that about six years ago he published in that journal a note in which it was shown that on the modern theory of magnetism any magnetic substance should become magnetised by a sort of molecular gyroscopic process on being set into rotation. Rotation should produce in any substance an intrinsic magnetic intensity parallel to the axis of rotation, proportional to the angular velocity, and (like the magnetisation of the earth) directed oppositely to the magnetic intensity which would be produced by an electric current circulating around the substance in the direction of rotation. If the rotating body were magnetic, magnetisation, proportional to the intensity, should result; otherwise not (except to a very minute extent).

Preliminary experiments mentioned in the note referred to appeared, though doubtfully, to show the effect in question in the case of a large iron rod rotated at a speed of about 90 revolutions per second.

Recently he has made, with Mrs. Barnett's assistance, experiments which have yielded definite and conclusive results. In the final experiments two nearly similar rods of steel shafting were mounted with their axes horizontal and perpendicular to the magnetic meridian, and two similar coils of insulated wire were mounted about their centres. These coils were connected in series with one another and with a Grassot fluxmeter, and were oppositely wound so that any variations in the intensity of the earth's field produced no effect on the fluxmeter. One of the rods remained at rest; while the other, mounted in a region in which the earth's magnetic intensity was compensated by an electric current flowing in a very large coil, was alternately rotated by an air motor and brought to rest, the change of flux for different speeds and different directions of rotation being determined by the fluxmeter. The fluxmeter was compensated for extraneous electromotive forces, and was read by mirror and scale to 0·1 mm. at the scale distance 8 metres. After all suspected sources of systematic error were eliminated, an effect was left corresponding precisely with that predicted by the above theory and inexplicable on any other theory hitherto proposed. The intrinsic magnetic intensity of rotation per unit speed, and the change of flux-density at the centre of the iron rod per unit speed, were found to be $3{\cdot}1 \times 10^{-7}$ gauss/R.P.S. and $1{\cdot}9 \times 10^{-5}$ maxwells/cm.^{2} per R.P.S., respectively.

It is not, of course, possible to obtain iron rods entirely free from magnetisation, and observations were always made on changes of residual flux. Together with the change of flux proportionable to the angular velocity, the effect being looked for, another change, proportional to the square of the angular velocity, was found and traced to the radial expansion of the rod produced by rotation.

The intensity of magnetisation per unit speed produced at the centre of the iron rod was about $1{\cdot}5 \times 10^{-6}$, C.G.S. unit per R.P.S. If the rod had been rotated at the speed of the earth, viz., 1/86,400 R.P.S., its intensity of magnetisation would have been about 2×10^{-10} that of the earth, and still less if the shape had been spherical. This, however, does not prove that even a very large part of the earth's magnetisation may not be due to the effect in question, as we are entirely ignorant of the magnetic properties of all substances under the conditions prevailing within almost the whole of the earth. Schuster has pointed out that an effect of this kind may explain both the mean magnetisation of the earth and the secular variation as well. It seems more likely, however, that a large part of terrestrial and solar magnetisation is due to other causes, such as the outward radial displacement of electrons by centrifugal and thermionic action.

Western Electric Co.'s Disaster.—The catastrophe which occurred on July 24th in Chicago, when the steamer *Eastland* capsized in the Chicago River with many thousand excursionists, resulted in a known death roll of Western Electric employés of 446, with 289 employés still missing. The Western Electric Co. made provision for the relief of the stricken families. On January 1st, 1913, a 10-million-dollar fund set aside by the American Telephone and Telegraph Co. for pensions, sick benefits and life insurance for the 175,000 employés of the Bell system became available. Under the plan inaugurated, the beneficiaries of all employés of more than 10 years' standing who die by sickness or accident occurring outside the employment of the Western Electric Co. will receive an amount equal to one year's pay, and beneficiaries of those between five and 10 years' standing will receive one-half of one year's pay, the maximum payment being $2,000. It is also provided that beneficiaries of all employés killed in performance of work for the company are entitled to three years' wages, the total amount not to exceed $5,000. In addition to the fund that is thus made available, Mr. H. B. Thayer, president of the Western Electric Co., announced a further contribution of $100,000 toward the relief fund. While no figures have been compiled regarding the amount of insurance benefits which will be paid out of the company's fund, a conservative estimate places it at $200,000.—*Electrical World.*

Electrical Trades Wages Arbitration.—The award of the Arbitrator, Sir David Harrel, in connection with the recent arbitration proceedings between the Electrical Trades Union and the London Electrical Masters' Association, was issued on Friday last week. It authorises an increase of ¾d. per hour, which, together with the advance of 1d. per hour which was made last year, makes a total increase of 1¾d. per hour for electrical wiremen and fitters in the London district in about 15 months. The award reads as follows:—

On March 9th, 1915, application was made by the London District Secretary of the Electrical Trades Union to the London Electrical Masters' Association for an advance of wages from 10½d. to 1s. per hour, and a reduction of the working hours to 48 per week.

The Employers' Association intimated that they were unable to accede to this request, and these matters were therefore considered at a meeting of the Joint Committee of representatives of the parties on April 30th and at a general meeting of the Electrical Masters' Association on May 10th, but no agreement was arrived at on these questions.

On June 10th application was made to the Chief Industrial Commissioner by the secretary of the men's Union for the appointment of an Arbitrator to decide upon the application for an advance of wages from 10½d. to 1s. per hour for electrical wiremen and fitters with *pro rata* advances to electricians' labourers and assistants, it being subsequently explained that the question of the reduction of hours was unreservedly withdrawn.

After some negotiations, the Employers' Association concurred in the reference of the matter to arbitration, and the Chief Industrial Commissioner having appointed me, David Harrel, to act as arbitrator in the matter, I heard representatives of the parties on August 5th.

After giving careful consideration to the statements and arguments made before me, I hereby award that the existing rate shall be raised from 10½d. to 11¼d. per hour, with *pro rata* advances to electricians' labourers and assistants, such advanced rate to come into operation as from the beginning of the first pay day following the date hereof, and the advance now awarded to be regarded as war wages and recognised as due to, and dependent on, the existence of the abnormal conditions now prevailing in consequence of the war.

Through Business Eyes.—The ill-effects that may attend a sudden cutting down of expenditure on advertisements were discussed last week by Mr. H. E. Morgan, of Messrs. W. H. Smith & Sons. To a London news agency representative he declared that expenditure on advertising in these changing and critical times was a matter requiring the greatest consideration. It was as reckless to apply the brake suddenly as it was to spend unwisely. It was necessary to adjust expenditure to the conditions which might prevail at any given time.

While this was sound business, the complete stoppage of advertising was utterly unsound. Goodwill was an asset, and was only to be kept alive if it was fertilised, and the loss incurred by stopping most kinds of advertising would be greater than the loss, if any, incurred by continuing.

"The manufacture and sale of articles in those huge quantities which make for the most economical production," he asserted, "is only possible in the present day with advertising. Advertising is the cheapest form of distribution. The specially made non-advertised article is really a luxury and is losing ground. Advertising is a national economy, replacing as it does the human salesman. When distribution can be achieved by the use of the printed word, the human salesman can be released for national duties."

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—*Company Orders.*—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week ending August 28th, 1915.

Monday, Wednesday and Friday.—Drills, 6.30 and 7.30 p.m.

Application for Enrolment.—All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. Fleming,
Company Commander and Acting Adjutant.

Good work is being done by the various sections of the Corps, both in drill and in the special technical work under the staff of the London Electrical Engineers (T.F.), for which this Corps has been organised. Arrangements for the use of a miniature rifle range, with rifles and instructor, are being completed, so that members will be able to take rifle practice at any hour of the day most convenient to themselves.

Recruits will be welcome from all those who are willing to fit themselves by training for military engineering work; it is not necessary that they should be members of one of the Engineering Institutions, although the Corps has been organised primarily among the membership of the Institutions, and applications from men with an engineering bent, even if in other occupations, will be entertained. Applications should be addressed to Lieut.-Col. C. B. Clay, Marconi House, Strand.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, August 19th, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade as strong as possible at Cumberland Gate, Regent's Park, at 2.30 p.m., and proceed by march route to Wembley, *viâ* Gladstone Park. Rucksacks will be carried. Members can use their own discretion as to what they carry in the rucksacks, but the total weight of these articles should not be less than 20 lb.

Sunday, 7 a.m., Réveillé; 10 a.m., Church Parade; 10.20 a.m., Parade under Company Commanders; 2.15 p.m., Battalion Parade.

Musketry.—Bisley Targets.—Sunday, 22nd inst. Men who have sent in their names will report themselves to Sergt. Cotter at the Barrier of No. 9 Platform, Waterloo Station, at 10.45 a.m. Dress: Uniform with Rifle and Sidearms. Men are recommended to take their lunch with them.

There will be no shooting at Bisley on Saturday, 21st inst.

Acton Range.—Saturday, the 21st inst., at 2.30 p.m. Shooting for all Companies. Names to be in by Friday evening. Tuesday next, the 24th inst., at 2.30 p.m. Shooting for all Companies. There will be no shooting at Acton on Thursdays, until further notice.

A. G. Joiner, *Captain and Adjutant.*

Lead.—Reports on the lead market from Messrs. James Forster & Co. show a slight decline in price on the first week, arrivals being heavy. Messrs. G. Cawson advise that American quotations were still above London parity. On the second week there was a considerable fall, the price opening at £23 5s., and being as low as £20 5s. on August 12th. It recovered 10s. by the end of the week. This fall was due to supplies coming in freely, and promoted a good business. The American market is lower, but still 30s. to £2 above London parity. Supplies from Mexico are not looked for at present, the situation being still too unsettled. Improvement in price is anticipated after the heavy selling both by speculators and importers.

Messrs. Robert Hammond & Son.—In a circular letter announcing the death of their senior partner, Mr. Robert Hammond, Messrs. Robert Hammond & Son state that it is the intention of the firm to carry on the practice under the old name and at the same address (64, Victoria Street, Westminster). Pending the return to civil life of the junior partner, Captain R. W. Hammond, now on active service, Messrs. Preece, Cardew, Snell and Rider have kindly undertaken to execute, on behalf of the firm, all work now in hand, and any future work which may be entrusted to the firm.

Appointments Vacant.—Handy man, for overhead trolley line, &c., for Dover Corporation Tramways; pupil for Barnsley Corporation Electricity Works. Particulars are given in our advertisement pages.

Fatality.—In connection with the death from electric shock of a Halifax tramway car cleaner, Archibald Hemingway, to which reference was made last week, the evidence given at the inquest showed that Hemingway was at work on the top of a car, and when found was in a state of collapse, with one hand fast between the trolley standard and the spring bolt, and the other clutching the outer rail of the car. The man was released and artificial respiration tried without success.

Mr. Galloway, tramway engineer, agreed that the conditions indicated a defect in the car, and suggested that when out during the previous night the trolley head had been struck by lightning during a thunderstorm, with the result that the earth-wire and insulation of the standard were destroyed; under such conditions Hemingway would receive a 500-volt shock when touching the standard and hand-rail at the same time. No such accident had previously occurred at Halifax, and he agreed that the defect would have been detected if the car had been previously examined, which was scarcely practicable. As a precaution, it would be possible to remove the trolley head from the wire and work with the shed lights when cleaning on an open top deck, but the car lights were essential for inside car work. After a lengthy inquiry, the jury returned a verdict of "Accidental death."

Royal Society of Arts.—Mr. R. Le Neve Foster has presented the Society with a donation of £140 for the purpose of founding a prize in commemoration of his father, Mr. Peter Le Neve Foster, who was secretary of the Society from 1853 to 1879, and the Council has determined to offer the prize for a paper on "Zinc, its Production and Industrial Applications." The prize will consist of a sum of £10 and the Society's silver medal. Intending competitors should send in their papers not later than December 31st, 1915, to the Secretary of the Royal Society of Arts, Adelphi, London, W.C., from whom particulars can be obtained.

Copper.—Stocks in friendly countries continue to increase slowly. Messrs. H. R. Merton & Co.'s statistical report for the fortnight ending August 14th, 1915, shows English stocks 24,389 tons, against 23,959 tons for the end of July, and compared with 16,778 on July 15th, 1914. French stocks are 5,554 tons, and the total European visible supply is 41,716. This, however, includes 3,973 tons, a pre-war figure, allotted to Hamburg and Bremen.

Detailed supplies show arrivals from North America, low; Spain and Portugal, high; "other countries," equal to pre-war average; shipments from Chile just below pre-war average; and Australian shipments for the fortnight 1,000 tons, against pre-war average 1,655 tons. Total deliveries, if not exceeded in the coming fortnight, will be about equal to those of February, 1915, *i.e.*, a good deal higher than for August, 1914.

The total deliveries for the year completed July 31st, 1915, amounted to 384,749 tons, against 570,969 tons for the preceding year. As the figures in most cases refer to European arrivals, it does not necessarily follow that the decrease is all in friendly countries.

Inquiries.—Makers of Edison, Goliath, and other screw-type lampholders are urgently inquired for. Large orders are to be placed. A machine to compress the graphite and manganese cylinders on the carbons of dry cells is inquired for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. W. Barry Adams has resigned his position with the Barcelona Traction, Light and Power Co., and has joined the staff of the Rio Tinto Co., Ltd. His address in future will be c/o Rio Tinto Co., Huelva, Spain.

Mr. F. H. Lowe, shift engineer at the King's Lynn Corporation electricity works, has joined the Forces.

At Holy Trinity Church, Exmouth, on August 8th, the marriage took place of Mr. W. J. Oxenham, engineer and manager to the Launceston and District Electric Supply Co., Ltd., and Miss A. E. Ferris, daughter of the late Mr. E. G. Ferris, of The Strand, Exmouth.

The Greenock Corporation Electricity Committee has recommended an increase of £100 in the salary of the engineer, Mr. Frank H. Whysall. Mr. Whysall was appointed a year ago, and his first financial report shows a surplus of about £10,000.

Mr. A. E. Wilson, deputy city electrical engineer, Bristol, having been selected by the War Office for the appointment of Electrical Engineer to the Chief Engineer, Southern Command, has resigned his present appointment and takes up his new duties at Salisbury on the 23rd inst.

Tramway Officials.—Inspector W. F. Richardson, of the Birmingham tramway department, has received a commission in the 18th Service Battalion of the Middlesex Regiment. He was in the Army for some years, and left as a Colour-Sergeant, joining the Tramway. He rejoined last August, and was appointed drill instructor to the 3rd City Battalion at Moseley College.—*Birmingham Daily Post.*

Mr. Henry Mattinson, one of the chief officials in the Manchester Corporation tramway department, has obtained a commission in the Royal Engineers.

General.—Sergt. James Jackson, of the Berwickshire Territorials, who was electrician to the Earl of Home, at Hirsel, has been wounded in action.

At Illogan (Cornwall) on August 7th, the marriage took place of Mr. J. G. Meneer, late chief electrician at South Crofty mines, and now in the Royal Flying Corps, and Miss Ida Kate Bath, of Trelowith.

Mr. Samuel Lemon, who has warrant rank as a telegraphist on the patrol ship *Alsatian*, the flagship of Rear Admiral de Chier, has been awarded the Distinguished Service Cross. He lives at Fleetwood, and was formerly in the telegraph office at the Fleetwood Railway Station. Later he became a wireless operator, first on the ss. *Viking*, and then on the ss. *Alsatian*.

Captain Herbert Bailey, electrical engineer, who has been wounded in action in the Dardanelles, formerly lived at Blackburn, but on the outbreak of war was in China. He returned to this country and resumed his association with the Territorials, being at once appointed Captain and Adjutant of the 2/4 East Lancashire Regiment. He went out with a draft of men to the Dardanelles about a month ago.

Mr. Walter Langdon-Davies, well known as one of the pioneers of the single-phase induction motor (who is not to be confused with a member of the Union of Democratic Control of similar name), has returned from Vancouver, B.C., where he has been for some years laboratory superintendent over the lines of the British Columbia Electric Railway Co., and has taken an office at 7, Quality Court, Chancery Lane, W.C. He is developing a new patent arc welder.

We are informed that Mr. J. F. Shipley has taken up the position of engineer to Messrs. Graham, Rowe & Co., of Liverpool.

Mr. Chas. Roland Robson-Muller, electrical engineer, residing at "Chevening," 11, Park Drive, Hampstead, announces in the *London Gazette* that on July 8th he renounced the surname of Robson-Muller, and adopted the name of Chas. R. Robson.

Roll of Honour.—Mr. S. J. Daniels, who was an instrument maker at the Marconi Works at Chelmsford, has died at Malta whilst on active service. Last October he joined the Royal Engineers Wireless Signal Section, and left for the Dardanelles about 10 weeks ago.

Rifleman Geo. Booth, of the 9th Battalion King's Royal Rifles, who was on the electricians' staff at Creswell Colliery, and was trained at Sheffield University, has been killed in action.

The death, from wounds received at the Dardanelles, of Mr. W. A. B. Kirwan Ward, was recently announced. Mr. Kirwan Ward commenced his business career with the National Telephone Co., subsequently joining the Constantinople Telephone Co., where he remained until October, 1913. He was next associated with the Relay Automatic Telephone Co. (then called the Betulander Automatic Telephone Co.), and was for some time employed in London and in France in connection with the installation erected in the Bois de Boulogne. On the outbreak of war he was called up to serve with his company, in which he held the rank of second lieutenant, and about six weeks ago was ordered to Alexandria, with a view to joining the Mediterranean Force in the Dardanelles. He was very popular with the staff with whom he served, and will be remembered by some of the Marconi staff as the representative of the Relay Co. in the competition for the Tennis Challenge Cup.

Private Herbert Smith, of the 15th Manchester Regiment, of Eccles, who has died from wounds received in the fighting at the Dardanelles, was a draughtsman in the employ of Messrs. Eckstein, Heap & Co., electrical engineers, Manchester.

Obituary.—Much sympathy has been expressed with Mr. W. H. Miller, the Fleetwood Council's electrical engineer, in the loss of his wife. Mr. and Mrs. Miller were on a motoring holiday when Mrs. Miller was taken ill and had to return home by train. She was 37 years of age.

We regret to record that Mr. Thos. L. Hellyar, of King Street, Hammersmith, electrical engineer and contractor, who retired four years ago, died on August 13th after an operation. He had been connected with the electrical trades for very many years, and was well known amongst electrical men.

Mr. J. A. Seager.—With great regret we announce the death of Mr. J. A. Seager, B.Sc., of Bristol, who for many years was a regular and valued contributor to our pages, and a personal friend whom we held in high esteem. Mr. Seager was the son of the Rev. Jno. Seager, of Truro. For some years he was lecturer in electricity at Nottingham University, and afterwards he was employed on the staff of the Charing Cross and City Electricity Supply Co. at their Bow generating station. Later he joined the Newcastle and District Electric Supply Co., taking charge of their publicity department; in this capacity he edited the *Tyneside Pioneer*, and much of the publicity literature of the company. In 1911 he went to Bristol, and took up an appointment with the United Stone Firms. He became an Associate of the Institution of Electrical Engineers in 1900. He was an able and prolific writer on engineering subjects, and his "Simple Stories," which he contributed to our columns over the pseudonym of "Innocens," were characterised by a gentle satire and a keen sense of humour which rendered them exceptionally enjoyable. As he rarely wrote over his own signature, the readers of the Electrical Review and other technical journals, both British and American, for which he wrote, are not aware of the extent to which engineering literature is indebted to his pen. Modest and unassuming to a degree, cheery and witty in conversation, and of untiring industry, he was a friend whom we could ill spare, and we tender our sincere sympathy to his relatives.

NEW COMPANIES REGISTERED.

Patent Lighting Co., Ltd. (141,238).—This company was registered on August 10th, with a capital of £100 in £1 shares, to carry on the business of manufacturers of and dealers in appliances connected with the lighting or heating (by gas, electricity, or otherwise) or ventilating of railway carriages, tramcars, ships, boats, buoys, buildings, etc. Power is also taken to manufacture munitions, etc. The subscribers (with one share each) are: A. Hall, J.P., D.L., Barkway House, near Royston, Herts.; C. P. Whitcombe, Durward House, Kensington Court, W., civil engineer; F. C. Fairholme, Nether Hale, Hathersage, Derbyshire, civil engineer; D. M. Leslie, 49, Charing Cross, S.W., bank clerk; J. Russell, 15, Victoria Street, S.W., M.Inst.C.E.; H. A. Butler, 13, Fenchurch Buildings, E.C., wine merchant; F. R. C. Worsley, 28, St. George's Road, S.W., secretary, public company. Minimum cash subscription, 20 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven; the first are W. B. Rickman, A. Hall, C. P. Whitcombe, and F. C. Fairholme. Qualification, £10. Remuneration, £1,050 to £1,550 per annum (according to dividends) divided between them. The Board of Trade has authorised the acquisition by this company of the undertakings of Pintsch's Patent Lighting Co., Ltd., and Pintsch's Electric Manufacturing Co., Ltd., the books and documents of which are liable to inspection under Section 2 (2) of the Trading with the Enemy Act, 1914. Registered by Blyth, Dutton, Hartley & Blyth, 112, Gresham House, Old Broad Street, E.C.

Killorglin Electric Light and Power Co., Ltd. (4,268).—This company was registered in Dublin on August 11th, with a capital of £1,650 in £1 shares, to carry on at Killorglin, Co. Kerry, the business of an electric supply company in all it branches. The subscribers are: J. Diggan, Killorglin, merchant, 25 shares; D. M. O'Sullivan, Killorglin, merchant, 50 shares; D. Murphy, Killorglin, merchant, 25 shares; W. Crowley, Killorglin, merchant, 60 shares; T. O'Donnell, Killorglin, merchant, 25 shares; P. J. O'Shea, Killorglin, merchant, 40 shares; J. O'Regan, Killorglin, merchant, 25 shares. The number of directors is not to be less than three or more than seven; the first are D. M. O'Sullivan, D. Murphy, J. O'Regan, J. Diggan, W. Crowley, T. O'Donnell, P. O'Shea, and E. L. Cantwell. Qualification, £25. Remuneration as fixed by the company. Registered office: Power House, Killorglin, Co. Kerry.

Industrial Invention, Ltd. (141,222).—This company was registered on August 8th, with a capital of £3,000 in £1 shares, to carry out experiments and research work chiefly in the direction of deposition of metals and utilisation of waste products. The subscribers (with one share each) are: F. H. Skimmell, 30a, Glenfield Road, Balham, S.W., clerk; J. Camp, 14, Serjeants' Inn, E.C., registration agent. Private company. The first directors are not named. Solicitor: T. H. Goodwin, 10, Basinghall Street, E.C. Registered by C. Doubble, 14, Serjeants' Inn, E.C.

Electric Safety Hoists, Ltd. (141,264).—This company was registered on August 13th, with a capital of £500 in £1 shares, to take over the business of a dealer in patent electric safety hoists and all electrical appliances, manufacturer and equipper of electrical plant, machinery and stock, manufacturers' agent, electrical and mechanical engineer, etc., carried on by A. H. Colley at Seaton Building, Water Street, Liverpool, as the "Star Electrical Co." The subscribers (with one share each) are: A. H. Colley, 17, Water Street, Liverpool, electrical engineer; L. H. Wright, 24, Water Street, Liverpool, biscuit manufacturer and miller; E. C. Marriatt, Patterdale, Egerton Park, Rock Ferry, Cheshire, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are A. H. Colley (permanent managing director) and L. H. Wright. Qualification, £50. Remuneration as fixed by the company. Solicitor: R. B. Jones, 50, Sir Thomas Street, Liverpool. Secretary: Elsie M. Colley. Registered office: Seaton Buildings, 17, Water Street, Liverpool.

"Ballantyne" Submarine-Craft Detector and Telegraphs, Ltd. (9,452).—This company was registered in Edinburgh on August 12th, with a capital of £500 in 115 preference and 350 ordinary shares of £1 each and 700 deferred shares of 1s. each, to provide for making and testing of an experimental apparatus and acquiring certain valuable inventions relating to "apparatus for the detection and location of submarine craft and submarine telegraphy between ships or ships and shore," and to carry on the business of experimental engineers, etc. The subscribers (with one share each) are: H. A. Lamont, 4, Annandale Terrace, Old Kilpatrick, Dumbarton, mechanical engineer; R. Semple, jun., Braeside House, Johnstone, Renfrewshire, mechanical engineer. Private company. The number of directors is not to be less than three or more than five; the first are J. H. Ballantyne, R. Semple, jun., and D. Mactaggart. Qualification, 50 ordinary or 50 deferred shares. Remuneration, £5 per annum, or any sum which may be determined. Registered office: Glasgow.

CITY NOTES.

Marconi's Wireless Telegraph Co, Ltd.

Senator G. Marconi presided, on Wednesday, over an extraordinary general meeting of the shareholders, held at Marconi House, Strand, when the resolution agreed to at the ordinary general meeting for the alteration of certain of the Articles of Association was confirmed as a special resolution. The Chairman said it might interest the shareholders to know that wireless communication had been established between the United States and Japan by means of the company's stations in America and the Pacific. That was very satisfactory, as a regular commercial service would soon be opened for the receipt of public messages, and it would also be available from England *via* their stations in the United States. That brought them one point nearer to the completion of their general programme by means of which they were going to establish wireless telegraphic communication between various parts of the world.

Mather & Platt, Ltd.—Interim dividend on the ordinary shares of 3 per cent., less income-tax, for the half-year to June 30th, being at the rate of 6 per cent. per annum.

Official Notices re Companies.—The following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Collieries Electric Power Development Syndicate.
Dimming Switches.
Duplex Radiators.
Electric Speller.
Horsfall Destructor Co.
Hydro-Electric Lift and Crane Co.
London Electric Treatment Co. (1911).
Magnet Galvanising and Plating Co.

County of Dorset Electric Supply Co., Ltd.

At the second ordinary general meeting of the company, held at Moorgate Court, Moorgate Place, London, E.C., on July 14th, 1915, the Chairman (Dr. J. A. Hosker) pointed out that the balance sheet to December 31st, 1914 (p. 181) showed that the company's progress from its commencement had been uniformly steady and satisfactory, and continued on the same lines in spite of the drawbacks incidental to the war. The cost of generation due to the increased price of coal, etc., had gone up, and necessarily increased the running expenses. Again, the restricted lighting orders, which had been so severely in force in all four towns, considerably reduced the amount normally used, especially for shop lighting purposes, and in the case of all consumers the economy which had been so widely practised had also had an effect on the consumption. In spite, however, of all these adverse factors the company had largely increased the number of consumers, in fact, during the war period they had added 86 new consumers and 4,325 lamps. June showed the largest increase in any month since the four companies had been in operation, as during this month lamps to the equivalent of over 1,000 30-watt lamps had been connected. An important factor in the company's progress had been the Dorchester prisoners' camp. This had recently doubled in capacity, and if it were still in use during the winter its requirements in the way of electricity should be more than double that used last winter. The works cost per unit had been less than half the cost for the same period last year, and the company's engineer reported that he hoped to have still better results during next winter. At Dorchester, for the month of January the generating cost came out at only .601d. per unit generated. During the half-year which had elapsed since the date of the balance sheet, the revenue had materially increased; in fact, at June 30th the receipts equalled fully two-thirds of the total for the whole previous year, while against a debit balance of £160 the company had now a net profit of £222, or already a net increase for the half-year of £382 over the whole year of 1914. Given the proportionate increase for the next half-year, the debit balance of the previous years should practically disappear.

The report was unanimously adopted, and Lieut.-Col. E. C. Castleman-Smith and Col. W. H. Baxter (the retiring directors) were re-elected directors of the company.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange is in a rather more confident mood. Why this should be, it is not easy to explain, but the firmness originated with a sharp fall in the rate of exchange for the Russian rouble. Rightly or wrongly, such a drop was interpreted as meaning that events in the Dardanelles were moving more quickly to a favourable conclusion, and the effect was felt in practically all departments. Rightly or wrongly, also, the impression spreads that the Austro-German effort must be regarded as virtually at its maximum, and that even if the enemy makes further progress into Russia, he will find it impossible to maintain his position, faced as he is with the possibility of another winter campaign.

Less superficial, but perhaps quite as effective, is the fact that the check to all investment which was imposed by the issue of the War Loan at the end of last June is steadily lifting. Capital is once more flowing into normal channels, and, bit by bit, securities which were all but unsaleable a month ago are being inquired for by their usual supporters, although, naturally, at the lower standard of values brought into being by the War Loan.

While the course of the Russian exchange affords ground for satisfaction and for hope, the position with regard to the United States exchange is far from pleasant. Even during the past few business days, the exchange has again moved sharply against this country. The committee formed to explore the situation, with a view to seeing what can be done to mitigate the difficulties and complexities arising out of the overweighted dollar, will earn the thanks of the business community the country through if they take such steps as will deal promptly and effectively with the situation—which, in point of fact, is distinctly grave.

Meanwhile, there is this gamble in all kinds of industrial shares which is taking place in America, and so developing an insecure internal basis upon which the expansion of the United States trade has to rest. The Stock Exchange watches the matter with growing concern, and it is difficult for the layman to see how a proper balance is to be restored what time gold is flowing out from this country, with very little to correct the efflux in the shape of exports from England or sale of American securities by British holders.

Mexican securities have come to a halt, after their fairly rapid rises, and there is a little disposition to wait and see what are likely to be the next developments. So far as can be observed, the pacification proposals do seem to be making headway—certainly slow, but, perhaps, none the less sure for all that—through the medium of the United States. Accordingly, Mexican Railway stocks are continuing to advance, though the industrials are scarcely so good this week. Mexican Light & Power first mortgage bonds reacted 5 points to 40, but the other gains of last week have been well held.

Brazilian Tractions, allowing for the dividend, are unchanged at 49, but interest in them as a speculative counter has shifted into some of the American "war specials"—now the pivots of the New York gamble. Brazilian Traction preferred keep firm about 75. There is a fair amount of business doing in the bonds of the various Canadian power companies, and Shawinigan Water common shares are better at 119, the rights being now valued about 1 per cent. Canadian General Electrics are about 110 for the common and 106½ for the preferred. Consolidated Gas, Electric Light & Power of Baltimore common are firm at 110. Kaministiquia Power capital stock has not changed hands for nearly four months, but Toronto Power debenture stocks are being dealt in on the basis of 87 for the 1918 issue and 86 for the consolidated guaranteed, both securities carrying 4½ per cent. interest.

The Victoria Falls & Transvaal Power report has further stimulated dealings in the shares, and the preference are comparatively active round about 15s. 6d., while the ordinary are called 4s. 6d.—5s., and the 5½ per cent. second mortgage debentures are 86.

The Telegraph market gives some indication of recovery. The recent pressure to sell has been removed, and greater attention is being directed to the cheapness of the best-class stocks in this section, such as those to which we have drawn attention as having fallen unduly far. To amplify our contention, it is, we hope, of interest to reproduce some of the most striking figures extracted from the reports for 1914 in the case of a few of the leading companies. We will take first the receipts, both gross and net, for the past two years, and it will be noticed that the comparisons make a very favourable showing:—

Company.	Gross receipts.		Working expenses.		Net receipts.	
	1913.	1914.	1913.	1914.	1913.	1914.
	£	£	£	£	£	£
Cuba Submarine	38,490	38,245	15,473	16,702	23,017	21,543
Direct Spanish ..	36,958	55,018	19,214	20,594	17,738	34,423
Eastern	1,462,844	1,646,741	685,218	786,449	777,626	859,293
Eastern Extension	738,129	819,583	354,864	364,979	383,265	454,604
Great Northern ...	575,601	682,309	229,470	250,590.	346,131	431,719
Indo-European	172,532	189,384	91,441	88,395	81,091	100,988
Western	889,710	830,056	360,738	389,943	528,972	440,113
	3,914,264	4,261,336	1,756,418	1,917,652	2,157,840	2,242,683

The Western Telegraph Co., which shows a decrease, closes its books at the end of June, so the above figures do not take into account the effects of the war. The Cuba Submarine is the only other company in the group having a decrease on the year. It is worth noticing how working expenses have risen, though, at the same time, gross receipts have more than kept pace with these.

Dividends for 1914 of the cable companies can be seen by reference to our price lists; and, to complete the figures, we may set out the reserves, etc., of the septet under examination. Taking the figures from the various balance sheets, this is what we find:—

Company.	Total capital.	Reserves.	Book value of cable, etc.	Cash and investments.
	£	£	£	£
Cuba Submarine	220,000	110,824	225,751	122,099
Direct Spanish	94,655	67,895	90,974	71,035
Eastern	8,000,000	2,396,969	8,040,752	1,981,552
Eastern Extension	3,752,400	1,140,680	3,806,837	936,459
Great Northern	1,500,000	2,551,015	1,623,518	2,307,278
Indo-European	425,000	297,067	56,316	661,220
Western	2,897,975	2,017,232	3,109,202	1,731,090

The above table shows the strength of the financial position occupied by the best cable concerns.

The Marconi group is much quieter, and business has fallen off considerably, with the result that the parent shares lost their previous week's rise, Americans are lowered to 18s. 6d., while Canadians keep strong at 6s. 3d.

In the market for home electric shares, the tone continues to be heavy. Westminsters, South Londons, St. James' and Chelseas are amongst those that have given way from ¼ to ½. Charing Cross ordinary and preference are both ex-dividend, and have recovered their deductions. The uncertainty of outlook with regard to coal is one of the reasons that keeps people out of this market, and another is the practical certainty that the lighting regulations are not likely to be relaxed, but, if anything, will be made more stringent as a result of the nocturnal visits from German gas-bags. The manufacturing shares are also somewhat easier, Edison & Swan, Electric Construction, General Electric preference, for instance, being amongst those which have reacted. Henley's Telegraph has declared the regular interim dividend of 10 per cent., and the Telegraph manufacturing shares keep steady.

The London & North-Western secured a success in its issue of 4½ per cent. preference stock at 96, the money being required in part for electrification of suburban lines. Travellers by the London & South-Western, by the way, are interested to notice the new electric stock which is making its appearance in different places, from which it would seem that the running of electric trains is likely to take place very shortly. Underground Electric income bonds have hardened to 74¼, but the "A" shares are 3d. lower at 5s. 9d. Sellers predominate in Central London ordinary assented stock, the nominal quotation being 73. Metropolitans and Districts maintain their previous prices.

The Armament section displays a disposition to weaken, and rubber shares are quiet. With raw rubber the merest shade better, it is thought that the round 2s. 6d. per lb. will shortly be reached again; in the meantime, rubber shareholders are by no means anxious sellers. The copper group is naturally languid and dull, in consequence of the depression in the price of the metal, and most of the leading shares show falls on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Aug. 17, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8	—	£6 5 0
do. 7 per cent. Pref.	7	7⅛	—	4 10 4
Charing Cross Ordinary	5	4 xd	+ ¼	6 5 0
do. do. do. 4½ Pref.	4½	4 xd	+ ⅛	5 12 6
do. do. City Pref.	4½	8⅞	—	5 16 2
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4⅝	— ⅛	5 14 3
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	13	—	6 18 6
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10¼	—	6 13 4
do. do. 6 per cent. Pref.	6	10½	—	5 14 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6½ xd	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	9⅜ xd	—	6 7 3
do. 4½ per cent. Pref.	4½	8½	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6⅞	— ¼	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅝	— ⅛	6 19 0
South Metropolitan Pref.	7	1⅜	—	6 4 5
Westminster Ordinary	9	6⅞	— ¼	6 18 4
do. 4½ Pref.	4½	4½	— ⅛	5 0 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	98	+1	6 2 6
do. Def.	1½	21½	—	7 1 2
Chile Telephone	3	8⅜	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11	—	*7 5 6
do. 4 Deb.	4	79	+1	5 2 1
Eastern Tel. Ord.	7	116	−1	*6 18 6
do. 3½ Pref.	3½	70	—	5 0 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9⅜	+ ¼	*7 0 8
do. Pref.	6	10	—	6 0 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	10	60	—	6 10 0
Marconi	10	1⅝	— 2/-	5 3 1
New York Tel. 4½	4½	97⅛	+1	4 12 3
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅞	—	*8 6 6
do. Pref.	6	4⅝	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11½	—	*6 19 0
do. 4 Deb.	4	81	—	4 16 5
Home Rails.				
Central London, Ord. Assented	4	78	—	5 8 1
Metropolitan	1½	23½	—	6 6 5
do. District	Nil	14	—	Nil
Underground Electric Ordinary	Nil	1½	—	Nil
do. do. "A"	Nil	5/9	−3d.	Nil
do. do. Income	6	74½	+ ½	*9 8 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4	—	6 17 6
do. 2nd Pref.	5½	5½	—	7 17 2
do. 4 Deb.	4	71	−2	5 12 7
do. 4½ Deb.	4½	75	—	6 0 0
do. 5 Deb.	5	71	−4	7 0 10
Brazil Tractions	3½	49 xd	—	7 2 10
Bombay Electric Pref.	6	10	— ½	6 0 0
do. 4½ Deb.	4½	87	−3	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	50	—	Nil
do. 6 per cent. Bonds	—	35	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	−5	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	98	−1	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	2⅜	— 1/2	6 8 5
British Aluminium Ord.	5	1⅝	—	4 14 1
do. Pref.	6	18/9	—	6 9 9
British Insulated Ord.	15	10¾	— ½	6 19 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	31/-	— 6d.	9 13 6
do. 4 Deb.	4	68	—	5 14 4
do. 6 p. lien	6	101	+1	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4⅜	—	5 5 3
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8½	—	4 19 6
Edison & Swan, £3 pd.	Nil	11/-	— 6d.	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	60	—	6 13 4
do. do. 5% Deb.	5	60	—	8 6 8
Electric Construction	6	11/-	−1/-	10 18 2
do. do. Pref.	7	19/-	−1/-	7 7 4
Gen. Elec. Pref.	6	9½	— ½	6 6 4
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4⅜	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8½	—	5 14 8
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Interim dividend of 2½ per cent. on the issued share capital in respect of the half-year ending July 31st, 1915, payable, less income-tax, on August 31st.

Electro-Bleach and By-Products.—Interim dividend of 3½ per cent. on preference shares in respect of year to December 31st next, payable September 1st.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	..	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	"	£9	..
a Bisulphide of Carbon	"	£23	£2 inc.
a Borax	"	£23	£1 inc.
a Copper Sulphate	"	£28	..
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	8½d.	1d. inc.
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	1/6	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	..	..
a " Chlorate	per lb.	1½	1d. inc.
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	5d.	1d. inc.
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	..	..
b " Sheet, in ton lots	"	..	..
g Babbitt's metal ingots	"	£50 to £291	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1⅞ to 1/2½	..
c " Tubes (solid drawn)	"	1/2 to 1/3⅜	..
c " Wire, basis	"	1/1⅞ to 1/2½	..
c Copper Tubes (solid drawn)	"	1/1½ to 1/2½	..
g " Bars (best selected)	per ton	£98	£4 dec.
g " Sheet	"	£98	£4 dec.
g " Rod	"	£98	£4 dec.
d " (Electrolytic) Bars	"	£82	£6 dec.
d " " Sheets	"	£100	£6 dec.
d " " Rods	"	£89	£5 dec.
d " " H.C. Wire	per lb.	11d.	½d. dec.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	6/10	..
b India-rubber, Para fine	"	2/4½	½d. dec.
f Iron Pig (Cleveland warrants)	per ton	65/1½	10½d. dec.
f " Wire, galv. No. 8, P.O. qual.	"	£26	..
g Lead, English Pig	"	£22	£2 15 dec.
g Mercury	per bot.	£18 5	..
c Mica (in original cases) small	per lb.	4d. to 2/6	..
c " " " medium	"	8/- to 5/-	..
c " " " large	"	6/6 to 10/6 & up.	..
c Nickel, sheet, wire, &c.	"	Nom.	..
g Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
g " " rolled bars & rods	"	1/2 to 1/3½	..
g " " rolled strip & sheet	"	1/3½ to 1/6½	..
c Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	"	£152	£6 dec.
n " Wire, Nos. 1 to 16	per lb.	2/7	1d. dec.
g White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Tyneside Electrical Development Co., Ltd.—Interim dividends for the half-year ended July 31st, at the rate of 6 per cent. per annum on the preferred ordinary shares, and 5 per cent. on the deferred ordinary shares, payable, less income-tax, on August 31st.

W. T. Henley's Telegraph Works Co., Ltd.—Interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, for the half-year ending June 30th last, both payable September 1st next.

Melbourne Electric Supply Co., Ltd.—Dividend at the rate of 7 per cent. per annum, less income-tax, on the first cumulative preference shares for the half-year ending August 31st, 1915, payable on September 1st.

Adelaide Electric Supply Co., Ltd.—Dividend at the rate of 6 per cent. per annum, less income-tax, on the cumulative preference shares, for the half-year ending August 31st, 1915, payable on September 1st.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1915.

THE last completed returns of electrical export and import business, dealing with the month of July, show a considerable decrease in values as compared with the preceding month.

Thus both the exports, valued at £371,732, as compared with £417,769 in the previous month, and the imports, which totalled £212,414, as against £223,801 in June, reveal a considerable falling off; the re-exports, on the other hand, advanced in value from £10,778 in June to £15,097 last month.

The decreased activity in the exports appears to have affected all sections except telegraphic and lamp exports, and the former of these was some £19,000 above the June total.

While machinery imports fell off considerably, cable, and telegraphic and telephonic imports reached higher values than in June.

In recent times Canada has turned importer of various electrical material into this country, while Spain has for some months been an appreciable source of electrical carbons.

During the month Victoria and India were the largest purchasers from this country, the export business being, however, well distributed over the world.

Rather less material was imported from the States than in June, and Belgium appears again in the list of importers.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,725	2,422	492	317	2,159	1,743	3,221	190	129	662	701	9,840	23,601
German West Africa	...	...	...	...	...	...	...	...	...	...	...	13	13
Netherlands, Java and Dutch Indies ...	279	5,057	455	...	...	...	131	...	12	...	94	3,156	9,184
Belgium	26	22	...	...	...	...	34	...	29	...	...	24	135
France	606	...	1,034	...	67	585	5,240	5,434	409	62	5,696	3,355	22,488
Portugal	30	3,736	...	139	...	281	47	275	23	...	447	4,500	9,478
Spain, Canary Isles and Spanish N. Africa...	554	53	199	...	...	563	3,025	29	...	8	16	293	4,740
Switzerland, Italy and Austria-Hungary ...	88	...	4	...	...	232	1,594	8	...	70	8,390	1,799	12,185
Greece, Roumania, Turkey and Bulgaria ...	20	...	...	...	...	...	219	4	...	...	3	3,884	4,130
Channel Isles, Gibraltar, Malta and Cyprus...	101	71	38	111	...	...	50	...	23	...	82	195	671
U.S.A., Philippines and Cuba	230	382	...	...	189	187	643	...	57	47	...	698	2,433
Canada and Newfoundland	115	243	119	...	...	1,432	489	...	302	...	...	18,100	20,800
British West Indies and British Guiana ...	154	174	61	74	56	66	113	...	11	...	...	70	779
Mexico and Central America	...	319	61	30	18	...	111	...	...	...	...	139	678
Peru and Uruguay	...	112	...	68	...	...	...	...	14	...	...	28	222
Chile	213	1,018	16	154	...	119	437	...	29	...	...	134	2,120
Brazil	104	930	665	361	89	501	1,407	460	448	...	73	304	5,342
Argentina	1,536	724	946	797	76	...	3,233	991	297	131	1,519	232	10,482
Colombia, Venezuela, Ecuador and Bolivia...	135	164	...	152	...	...	143	...	59	...	27	59	739
Persia	18	...	15	...	...	...	...	...	...	...	...	...	33
Egypt, Tunis and Morocco	60	209	129	753	...	...	236	326	49	11	67	2,424	4,264
British West Africa	60	2,401	10	15	...	...	129	...	578	36	113	5,894	9,236
Rhodesia, O.R.C. and Transvaal	682	300	1,034	1,200	1,170	296	2,589	...	1,414	112	188	16	9,021
Cape of Good Hope	832	2,613	698	711	...	594	5,002	...	665	64	40	160	11,179
Natal	296	2,930	738	...	...	363	6,249	1,183	133	45	321	59	12,317
Zanzibar, Brit. E. Africa, Mauritius & Aden	22	14	115	61	...	109	214	24	13	...	47	15,869	16,488
Azores, Madeira and Portuguese Africa ...	72	36	...	58	...	...	215	...	...	18	129	50	578
French African Colonies and Madagascar...	12	...	158	...	...	...	...	...	109	...	...	...	279
China and Siam	866	2,172	505	909	41	258	3,685	276	216	24	97	...	9,049
Japan and Korea	274	...	18	45	52	484	995	3,181	1,359	...	21	...	6,429
India	2,710	11,712	4,392	2,761	54	1,479	15,273	2,896	1,653	80	889	292	44,191
Ceylon	12	80	79	...	30	...	459	117	68	...	21	55	921
Straits Settlements, Fed. Malay States and Sarawak	812	672	888	92	...	733	1,117	298	62	33	853	121	5,681
Hong Kong	...	98	125	24	...	...	3,195	330	127	61	64	...	4,024
West Australia	110	339	191	1,532	...	262	...	68	425	...	17	...	2,944
South Australia	158	3,010	315	215	21	488	...	1,640	32	12	805	...	6,696
Victoria	849	19,692	2,262	929	...	512	18,286	1,989	193	163	2,043	468	47,386
New South Wales	1,504	4,199	1,533	1,155	65	132	12,398	1,060	1,621	735	2,498	3,137	30,037
Queensland	7	887	411	104	...	117	1,025	...	90	...	3,821	...	6,462
Tasmania	...	...	74	...	...	...	164	...	...	...	420	12	670
New Zealand and Fiji Islands	1,402	2,275	843	424	...	966	1,429	348	1,492	11	3,506	991	13,621
Total, £	16,674	68,684	19,005	13,191	4,087	12,242	92,797	21,127	12,061	2,385	33,008	76,371	371,732

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	1,117	2,738	17	...	688	...	4,124	...	932	1,116	3,923	14,655
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	...	...	...	7,049	523	...	629	...	...	...	1,375	9,576
Belgium	...	...	...	...	...	...	...	...	...	...	1,460	1,460
France	101	228	781	1,852	1,473	757	342	...	2,429	2,751	1,868	12,582
Switzerland	1,565	...	41	36	9	3,096	1,527	18	...	765	125	7,182
Italy	291	8,228	...	...	...	...	718	2,680	...	131	...	12,048
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	16,063	6,613	2,501	3,244	9,292	118	34,897	66,204	3,397	8,179	843	151,351
Total, £	19,137	17,807	3,340	12,181	11,985	3,971	12,237	68,902	6,758	12,942	9,594	208,854

Additional imports.—Spain, carbons, £1,794. Canada, goods, £291; wires and cables, £1,150; meters, £20; electrical machinery, £32; carbons, £148; telegraph and telephones, £125.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	2,199	505	39	1,054	40	530	5,311	...	1,615	1,582	2,222	15,097

TOTAL EXPORTS: £371,732 TOTAL RE-EXPORTS: £15,097 TOTAL IMPORTS: £212,414

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ALTERNATING-CURRENT CABLE TELEGRAPHY:

With Special Reference to Signal-Reception, Signal-Records, and Auto-re-Transmission.

By EDWARD RAYMOND-BARKER.

Lieut.-Colonel G. O. Squier, well known in the past*—cojointly with Dr. A. C. Crehore—as originator and advocate of telegraphic sine-wave transmission,† and for other important cable matter due to himself alone,‡ in his last inspiring paper recently read before the Physical Society,§ has not only broken new ground, but has opened up quite new vistas in submarine-cable signalling practice and development.

Lieut.-Colonel Squier has done this along lines illumined, from the onset, by points of arresting interest, and by a telling use of graphs.

Broadly considered from a practical point of view, the salient features of the new transmission system brought forward by Lieut.-Colonel Squier may be stated thus :—

1. The *unbroken* nature of the alternating current employed as medium for the formation and transmission of sine-wave signals of various amplitudes.

2. The inter-locking or inter-dependent gearing by which the auto-transmitter tape perforations are caused to move forward synchronously with the rotary generator which is the source of the sine-wave alternations : the resulting co-operation causing the changes of impedance in the generator primary circuit, controlled by the tape perforations, to take place severally at the zero periods occurring between successive rythmically-maintained current alternations : *positive* and *negative*.

Under the foregoing first heading cluster innumerable resulting advantages, due to the master fact that the transmitting current traversing the unbroken circuit *continues to pulsate* even during the various space-periods between letters, words and messages, whilst signals are produced by slightly increased amplitudes for "dot" signals of either *sign*, and by greater increase in amplitudes—*positive* or *negative*, as the case may be—for "dash" signals. Thus there are three degrees of alternations of either *sign*—namely, those severally pertaining to spaces, to "dots," and to "dashes," all these rhythmic pulsations being equal in period, though varying in amplitude.‖

One of the foremost of these advantages attaching to Lieut.-Colonel Squier's unbroken circuit is the ease apparent in cable-duplex balancing, even in cases where a Heurtley or an Orling magnifier is used across the duplex-bridge as receiver : a receiver—be it remembered—hitherto, in ordinary transmitting methods, riskily exposed to out-going heavy charge-impacts alternating with abrupt earthing periods, when these took effect under conditions of not absolutely perfect duplex balance.** Then, too, the unbroken and undulating nature of the alternating current involves safety to cable cores, even under increased initial voltages.

The present purpose of the writer, however, is not so much to comment on Lieut.-Colonel Squier's instructive presentment of sweeping yet desirable improvement schemes in telegraph-cable transmission practice, as to direct attention to the joint problems relating to :—

(*a*) *Reception* and *record* of the alternating-current signals at the receiving end of the line in *simplex*, and across the arms of the duplex-bridge at each end of a *duplex*-worked cable ; also to (*b*) the practicability of automatic re-transmission of alternating-current signals of equal period but of varying amplitude.

This problem of reception is of special interest to the writer, in view of his own previous work in this direction. This work is found to be on lines parallel to, but—in this one particular matter of uni-linear signal-record—advancing

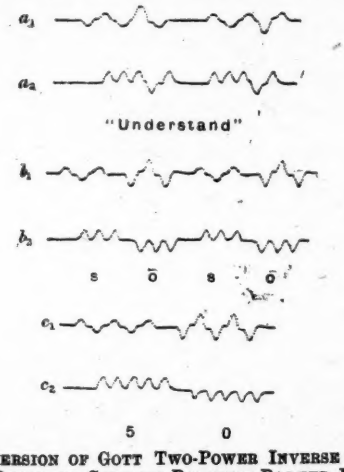


Fig. 1.—Conversion of Gott Two-Power Inverse Currents into Siphon-Recorder Code by Raymond-Barker Rectifier.

beyond the results attained by Lieut.-Colonel Squier. Indeed *rectification* and registration of alternating-current signals, in terms of uni-linear recorder-code, have, by the writer, been successfully effected, and the same electro-mechanism which has produced the *rectified* signals may be used for auto-re-transmission purposes.

The problem how to convert received alternating-current signals of more than one degree of amplitude as shown in a_1, b_1, c_1, fig. 1, into uni-linear siphon-recorder-code signals of the customary kind, as shown in a_2, b_2, c_2, fig. 1, first became urgent on the appearance of the late Mr. John

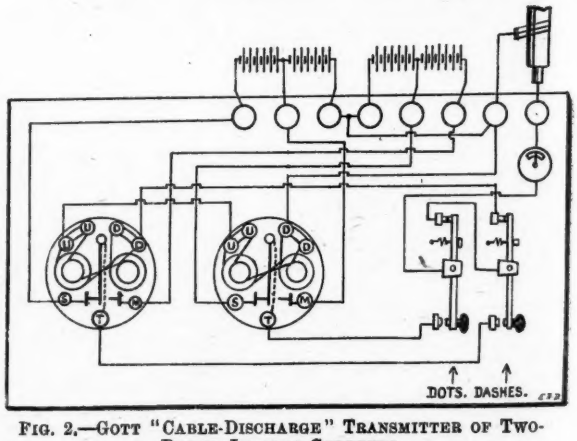


Fig. 2.—Gott "Cable-Discharge" Transmitter of Two-Power Inverse Currents.

Gott's device for sending into a cable two-power inverse-current impulses—that is to say, impulses alternating in *sign*, and differing only in amplitude.

The terms "inverse-current" and "alternating-current" are—in a way—synonymous, excepting that the former is conveniently used in connection with battery transmission in square-topped current-impacts, whereas the latter may well be reserved for use as relating to the dynamo-generated rhythmical sine-wave alternations so closely associated with the name of Lieut.-Colonel Squier.

Fig. 2 shows Mr. Gott's two-power inverse-current transmission device controlled by cable discharge, as used in

* The Synchronograph : "A New Method of Rapidly Transmitting Intelligence by the Alternating Current." By Albert Cushing Crehore and George Owen Squier. The Electrical Review, Vol. XL, No. 1,015, May 7th, 1897.

By the same authors : "Tests of the Synchronograph on the Telegraph Lines of the British Government." The Electrical Review, Vol. XLII, February 18th and February 25th (Nos. 1,056 and 1,057), 1898.

† An advocacy subsequently confirmed by the mathematical investigations of Dr. H. W. Malcolm.

‡ "An American Pacific Cable." By George Owen Squier. The Electrical Review, January 12th, 19th and 26th, 1900.

§ "On an Unbroken Alternating Current for Cable Telegraphy." A paper read by Lieut.-Colonel George O. Squier, Ph.D., before the Physical Society of London, June 25th, 1915. The Electrical Review, July 30th, and August 6th, 1915.

‖ Mr. Axel Orling, by means of a special arrangement, has dealt with this circumstance without in any way impairing or lessening the essentially great sensitiveness of the jet relay or magnifier.

** See Colonel Squier's fig. 4. The Electrical Review, July 30th, 1915.

practice by the writer. This invention, as described in Gott's British Patent, No. 10,534, 1912, whilst showing how two-power inverse-current transmission could be effected, offers no solution as to how these impulses, when received from a high-KR cable, are to be legibly recorded.

The writer, in his British Patent, No. 27,225, 1913, indicated :—

1. How Gott's received two-power inverse-current impulses could be *rectified* and registered in uni-linear recorder-code.

2. How the received two-power inverse-currents could be made to control and to re-transmit fresh two-power inverse-current, or any other class of impulse, into a second cable.

In fig. 1, a_1, b_1, c_1, indicate how Gott signals from a very short cable would be recorded if left unrectified.

In fig. 1, a_2, b_2, c_2, show the same signals converted by the writer's *rectifier*.

These last-mentioned records—it must be remembered—enjoy all the advantages accruing from inverse-current working, and the resulting maintenance of electrical equilibrium in the cable, with comparative absence of signal distortion.

It was with the keenest pleasure that the writer noted the arrangements made by Lieut.-Col. Squier for the recording of his alternating-current impulses of varied amplitudes—a system to which the writer's *rectifier*, already referred to, is found to be perfectly applicable.

Up to a certain point—as already mentioned—Col. Squier's methods of reception are similar to the writer's, the only difference being that the former comprises, as *receiver* and controller of the local circuits, a Muirhead gold-wire relay (shown in Col. Squier's fig. 5),* whereas, to fulfil a like purpose, the writer has employed an Orling jet relay.

Indeed, if recording siphons were placed on the armature levers of the two electromagnets constituting the first stage, only, of the writer's rectifying system (corresponding to Col. Squier's armatures $g\,g^1$ of electromagnets $h\,h^1$ in his fig. 5), a record as shown in fig. 3, a_3, b_3, c_3 would be obtained, which to all intents and purposes would be the same as that effected by Col. Squier, and shown in fig. 3, a_4, b_4, c_4, excepting that, by means of the pretty mechanical device described in his paper, Col. Squier secures greater symmetry in the grouping of his black dots.

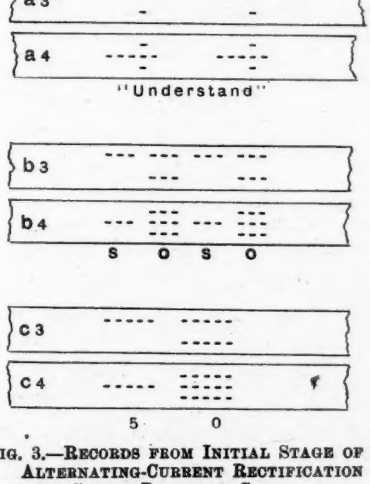


Fig. 3.—Records from Initial Stage of Alternating-Current Rectification into Siphon-Recorder Code.

There is, however, no need for one to rest content with black dots when the production of uni-linear recorder-code signals is feasible. An effective advance, therefore, may be made in this direction, especially in view of the fact that for avoidance of eye-fatigue during long hours of tense ocular and mental concentration, uni-linear signals would be considered by cable men highly preferable to a register composed of black dots. This is clear if we compare the rectified signals a_2, b_2, c_2 in fig. 1 with the corresponding signals in either of the two sets shown in fig. 3.

* The Electrical Review, July 30th, 1915.

Fig. 4 shows the writer's own form of transmitter for the production of Gott two-power inverse-current impulses. This instrument produced the parallel sets of signals—non-rectified and rectified—shown in fig. 1.

PC is a pole-changer of special design suggested to the writer by a radio-telegraphic device of Mr. Axel Orling, described in Albert Turpain's "*Les Applications Pratiques des Ondes Electriques*" : (C. Naud, Editeur, Paris.)

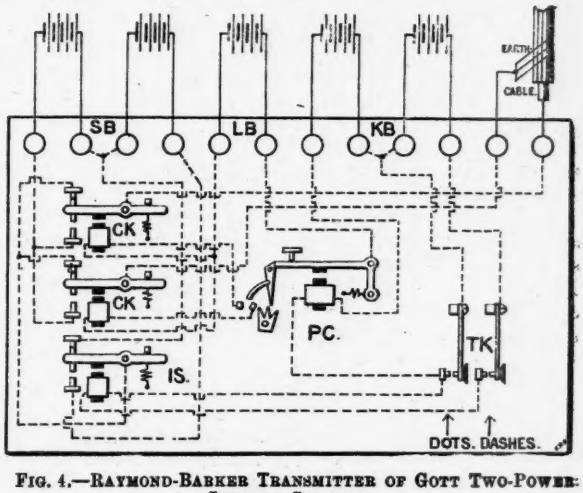


Fig. 4.—Raymond-Barker Transmitter of Gott Two-Power Inverse Currents.

The cable keys CK, CK, alternately actuated by PC, send impulses to line of alternate + and − *sign*.

The increment switch IS, when actuated, brings the higher battery-power into play.

The "dot" key of TK works PC, whereas the "dash" key works PC + IS. Thus the current-impulses passing to line are alternately + and −, increment of battery-power, irrespective of *sign*, being determined by the pressing of the "dash" key and the consequent working of IS as well as of PC.

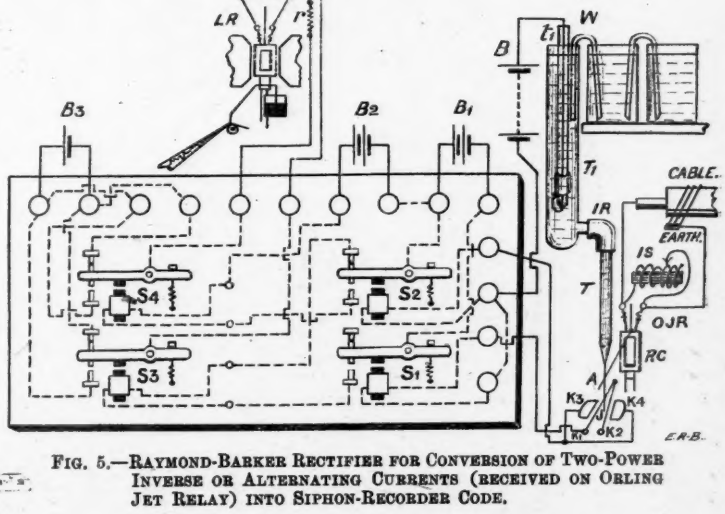


Fig. 5.—Raymond-Barker Rectifier for Conversion of Two-Power Inverse or Alternating Currents (received on Orling Jet Relay) into Siphon-Recorder Code.

A *direct* record of these signals would appear as in a_1, b_1, c_1, fig. 1.

Fig. 5* shows one form of the writer's *rectifier* controlled by an Orling jet relay—the receiver of the impulses from the cable. Weak "dot" impulses cause the water-jet J to impinge against K_1 or K_2 alternately, thus working S_1 which, in its turn actuates S_2 *through the armature-lever of* S_2. Strong "dash" impulses carry the jet further in

* Figs. 2, 4 and 5 are from a series of diagrams by the writer, connected with a work he has in course of preparation for the press.

either direction, and cause the jet J to impinge with practical simultaneity against K_1, K_3, or against K_2, K_4; thus causing both S_1 and S_2 to operate together.

S_2, in its turn, duly works S_4, but, in this case, S_1 is powerless to affect S_3, because the local circuit in which the coil of S_3 is included is interrupted by the armature of S_2, at this moment, being *down*.

Thus it is brought about that a weak deflection of the jet, irrespective of direction, works S_3 which is an electromagnetic "dot" key, whereas a stronger deflection of the jet infallibly works only S_4 which is a "dash" key.

S_3 and S_4 now constitute a common cable key, and if, between the two levers, one connect up the local siphon-recorder S R, one gets a *rectified* record as shown in a_2, b_2, c_2, fig. 1.

Also these same two levers of S_3 S_4 may be used to control, and to retransmit into a second cable, alternating-currents or any other form of signal.

In the working of the *rectifier*, the deflections of the jet against either K_1, K_3 or against K_2, K_4—thus working either S_1 or S_2 and S_2 simultaneously—correspond with those of Lieut.-Col. Squier's Muirhead gold wire f against the contacts f_4, f_4, which actuate either h, or h and h_1 simultaneously.

So, instead of recording (as shown in fig. 3) the armature workings of S_1 and S_2, the writer, by co-relating S_1, S_2, S_3, S_4, has produced:—

1. Uni-linear recorder-code signals.
2. Possible automatic re-transmission of two-power inverse-current impulses.

This *rectifier*, designed in the first instance to satisfy the reception requirements of Gott's two-power inverse-current transmission, is equally applicable to the needs of Lieut.-Colonel Squier's *unbroken alternating current*.

SOME WRINKLES ON THE OPERATION OF ALTERNATORS.

By E. B. PAUSEY.

The following hints on running alternating-current generators are based on practical experience, and are, as I have ascertained, not altogether matters of common knowledge. I venture to hope, therefore, that they may be of assistance to many of those who are in charge of the running of alternators.

At the present time power factor indicators are so universally installed on A.C. generator panels, and are so useful in preventing excessively heavy idle currents to circulate between machines running in parallel, that many switchboard operators feel rather lost if one or more of these instruments is removed for repairs or put out of commission in any way. A little thought, assisted by a simple vector diagram, will show that when all the machines in parallel have the same power factor, the sum of their main ammeter readings will be a minimum. Therefore, if the excitation of the machines is regulated so as to keep this figure a minimum, or as nearly so as possible, the absence of the power factor indicator will be compensated for.

Another use of a power-factor meter is in reducing the load on a machine preparatory to switching it out. It is well known that if the excitation of a machine be too weak or too strong at the time of switching it out, a more or less severe kick in the bus-bar voltage will occur, and that this can be avoided by regulating the field as the load is reduced according to the reading of the power-factor indicator. If the power-factor indicator be inoperative for any reason, the kick in the volts can be obviated by making sure that the field current is reduced to its "no-load" value before switching out. The no-load excitation current of every alternator in the station should be ascertained and noted for this purpose; and it will be found useful even where the power-factor indicator is in use.

Most A C. ammeters have a very close scale for some distance above the zero mark, so much so that in some cases a machine may be doing perhaps 10 per cent. or 15 per cent. of its load, and yet the ammeter reading be barely perceptible. In the absence of a wattmeter this makes it a difficult matter to know when the load is all off a machine and to avoid undesirable fluctuations in the voltage and frequency due to switching out with too much load on. In the case of generating sets with throttle governing the steam pressure necessary to run the set excited, but without load, should be ascertained and noted, and the driver should signal to the switchboard attendant when the pressure gauge on the engine side of the throttle valve indicates this no-load pressure. The switchboard attendant will then know certainly that the machine is nearly or quite without load. Another indication of the load being very nearly off is given by the power factor indicator, whose readings become very variable under those conditions, the needle moving through a considerable arc for a very small alteration of the field strength. This indication is not so reliable, however, as that of the pressure gauge above mentioned.

A simple matter, which everyone in charge of an A.C. switchboard ought to understand, but which many do not, is a means of testing the correctness of the synchroniser connections, so that they can be confidently passed as right after having been disconnected and connected up again. The method is this:—Plug any machine that is running on the bus-bars on to the synchroniser, in just the same manner as if it were to be synchronised. If all is right as regards that machine the instrument will indicate synchronism.

In case of accident to the synchroniser, a temporary arrangement consisting of a bank of lamps can be connected across the machine voltmeter plug of the incoming machine, one of the machines on load being plugged on to the machine voltmeter bus wire. These lamps will then indicate synchronism by being extinguished. Such an arrangement as this should, of course, only be used under the immediate supervision of a responsible person, since an error would have very serious effects.

A NEW BATTERY SIGNALLING BELL.

By W. M. THORNTON, D.Sc., D.Eng.

(*Paper read before the* North of England Institute of Mining and Mechanical Engineers.)

The recent important Home Office report by Dr. R. V. Wheeler on the risks of ignition of methane by battery signalling bells has proved beyond reasonable doubt that the spark in the bell or on the wires is a danger that must be dealt with. Before, however, this can be done effectually, it is necessary to know the nature of the spark, and the limits to its igniting power. Dr. Wheeler has given in his report several ways of improving the safety of bells, and much useful information for the guidance of bell manufacturers. The present paper is a statement of the chief points which arise in the working of such bells, and affect sparking; and an arrangement is described by which danger from the spark is prevented.

In the first place, the spark at the trembler contact is not continuous. If viewed in a revolving mirror, it is seen to be regularly intermittent; and if the current is observed by an oscillograph, it is found to have the general form shown in fig. 1.

In the case of an electric circuit of resistance r and inductance L, the curve OA has the form $i = E/r\,(1 - \epsilon^{-rt/L})$, where E is the battery voltage, and $\epsilon = 2\,718$, the base of the natural logarithms. E/r is the final steady value of the current i if the circuit is closed for a long time. In bells this curve is modified by the movement of the armature and by eddy currents in the solid parts of the magnetic circuit of the windings, and may become a straight line, as in fig. 2.

The voltage e, which causes the spark at the trembler contact is produced by the rush of magnetism out of the coils when the current is broken. It is, in fact, $L\,di/dt$, where L is the self-induction and di/dt the rate of break of the current. When L is in henries and di/dt in amperes per second, L di/dt is the voltage on the spark. At the moment of break the battery voltage is all absorbed in the resistance, and does not affect the initial value of e. The gap voltage as observed is that shown in fig. 3; after the spark has ceased, the voltage across the spark-gap is that of the battery alone.

In good bells the time of break is found to be about half that of make, and the maximum voltage v is about ten times that of the battery e. The spark at the trembler contact is a series of

ordinary break-sparks of short duration, in which both current and voltage are greatest at the instant of break.

Now, the igniting power of an electric break-spark depends on the voltage with which it is associated. It has been shown that the product of these is roughly constant, as in fig. 4. When the voltage is high, a small current becomes dangerous, and the degree of danger increases with the inductance in the circuit. With single continuous-current break-sparks on a 20-volt battery circuit, 0·5 henry causes ignition of the most inflammable mixtures of illuminating gas with a current of 0·5 ampere.

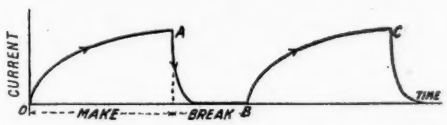


Fig. 1.—Curve of Current in a Battery Bell Circuit in Full Ringing.

Another factor of great importance is the duration of the spark. It is clear from the curves of figs. 1, 2 and 3 that the duration of the high voltage is small compared with the period of the bell. Measurements of curves taken show that it is sometimes as low as a fiftieth of the period, so that in a bell ringing 20 times a second

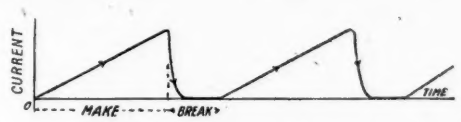


Fig. 2.—Form of Current-Curve Occasionally Found.

the time of high voltage is 1,000th of a second. So short a duration is less favourable to ignition than an ordinary non-inductive break-spark, and this may account to some extent for the rarity of accidents in coal mines which might have arisen from bells.

The power w of the bell-spark—that is, the product $\text{L}\,i\,di/dt$ of volts and amperes in it—is given in fig. 5, and is seen to be even

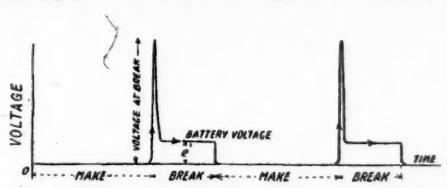


Fig. 3.—Voltage across Spark-Gap at Trembler Contact.

less uniform than the voltage. As shown in fig. 4, the ease of ignition of a given mixture by break-sparks, as measured by the product $\text{L}\,i$, is approximately constant. So long as w does not reach the critical value, the bell is safe. In order to keep w low, it is advisable to make the product $\text{L}\,i$ as small as possible, for the rate of break depends to a great extent on the mechanical design and setting of the bell. Measurements of L have been given

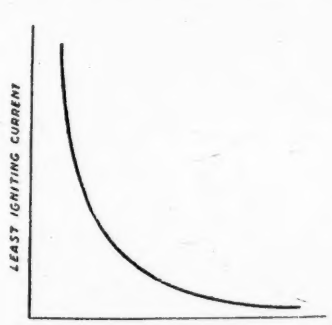


Fig. 4.—Change of Least Igniting Current with Voltage in a Non-Inductive Continuous-Current Circuit.

in the Home Office Report, and have since been found to reach the high value of 1 henry. There is an upper limit to the current, depending on the kind of battery used. It may be taken that signalling currents range on an average between 0·1 and 0·5 ampere, and the value of $\text{L}\,i$ from 0·05 to 0·1. There is no limit to the number of turns on the bell, that is, to the self-induction L. Expressed in terms of dimensions, $\text{L} = 4\pi\,\text{T}^2/\text{R}$, where T is the number of turns on the windings and R the reluctance of the magnetic circuit, which is equal to the average length of the magnetic lines of force divided by the sectional area of the core and by its magnetic permeability. The air-gap has a greater reluctance than the iron of the magnetic circuit.

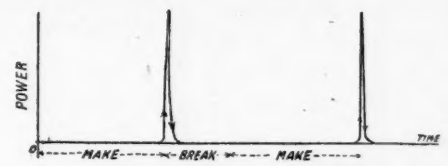


Fig. 5.—Volt-Amperes of Trembler Spark.

The total energy of the break-spark is $\frac{1}{2}\,\text{L}\,i^2 = 2\pi\,i^2\,\text{T}^2/\text{R}$. It therefore varies as the square of the amperes and turns on the coils for a given magnetic circuit. For a given number of ampere-turns it varies inversely as $\text{R} = l/\text{A}\,\mu$, where, since the air-gap has much greater magnetic resistance than the core of the coils, l is

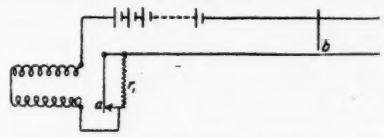


Fig. 6.—Shunt Resistance across Spark-Gap diminishes Spark at a, but Increases that on Line at b.

the double length of the air-gap, A the mean area of the magnetic field in the gap, and $\mu = 1$, when l and A are in centimetre measure. The product $\text{L}\,i$ is the number of lines of force N linked with the coil windings. N only affects the spark when changing, for

$$e_s = d\,\text{N}/d\,t = \text{L}\,d\,i/d\,t. \quad \text{L}\,i = 4\pi\,\text{T}^2\,i/\text{R},$$

and is, therefore, proportional to the current and to the square of the turns. The voltage

$$e_s = 4\pi\,\text{T}^2/\text{R}.\ d\,i/d\,t.$$

The rate of break depends so much on the mechanical adjustments that it is the least definite of all the important factors in sparking. For a fixed rate of break it is nearly proportional to the current broken. Writing $di/dt = ki$, the result is $e_s = 4\pi\,k\,\text{T}^2\,i/\text{R}$, following the same law as $\text{L}\,i$.

How does sparking depend upon the working resistance in the circuit? The greater the resistance r, the greater is the drop of

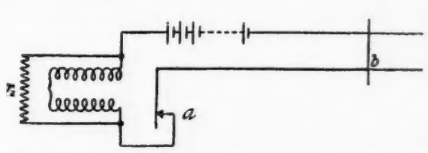


Fig. 7.—Resistance Across Magnet-Coils Suppresses Sparks Both at a and at b.

voltage in the wires for a given current, and the less of it there is for the gap while the current lasts. The equation of the current in the bell at break may be written $i = \text{E}/r\,.\,\epsilon^{-r_1 t/\text{L}}$, where r_1 is the resistance after break, including that of the spark. From this $e_s/\text{E} = r_1/r$, and the resistance of the spark r_s, which is $r_1 - r = r\,(e_s/\text{E} - 1)$.

The resistance of the spark is not independent of the current in the circuit, but it is clear that the greater the resistance r of the

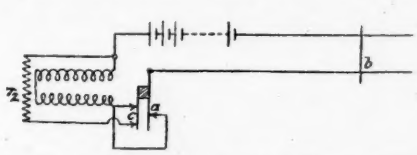


Fig. 8.—Resistance Connected at c Just Before Break at a.

circuit the smaller is the sparking voltage e_s for a given size of spark. Resistance in the battery or line, or bell-windings, therefore, diminishes the igniting power of the spark. Wet Leclanché cells, having a higher resistance than dry cells, are from this point of view safer. To ring over a long distance is safer than over a short distance, because the ratio r_1/r is less for the same ringing current.

From observed values of e_s the resistance of the spark at break can be found. A common ratio of e_s/E is about 10. Thus if $r = 6$ ohms, $r_s = 54$ ohms at the moment of break. This rapidly increases as the spark is drawn out and breaks.

For the purpose of preventing ignition of gas by a signalling bell, the first suggestion is to bridge the spark-gap by a resistance, but this may be in practice a positive danger, for by it a large part of the energy of the spark at the trembler is handed on to the signalling point on the wires. These wires are near the roof, and

there is probably more risk of inflammable mixtures being formed there than at a bell in a haulage-house. When the gap is bridged, there is no free gap at *a*, but there is at *b*, and it has been shown by Mr. C. P. Sparks, and also by Dr. Wheeler, that there is danger of ignition there equal to that at *a* under normal working conditions (fig. 6).

When, however, a suitable resistance is placed across the terminals of the coils, and the gap left unbridged, a break there gives rise to a spark of much less magnitude. The resistance r_2 may be always connected (fig. 7), or it may be so arranged that it is joined up by the movement of the armature just before break (fig. 8), so avoiding the small current which passes through r_2 continually while the bell is ringing. The value of r_2, so as to give the best results in practice, is found to vary from 20 to 150 ohms, depending on the design of the bell. This resistance provides a path for the "extra current" at break. In other words, the voltage *e*, at the spark-gap stops at the moment when it begins, for the current and magnetism in the coils die down slowly instead of being broken suddenly. Oscillograph records such as those illustrated in fig. 9 show that the voltage across the gap never

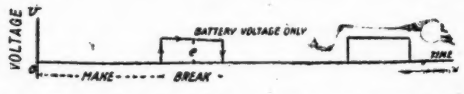


Fig. 9.—Voltage across Spark-Gap when Resistance is Connected as in Figs. 7 or 8.

rises above the battery volts, and the igniting power of the spark is reduced, or the factor of safety increased, by at least 4 or 5 to 1; and by 10 to 1 if the voltage only is considered.

The effect of the suppression of the sparking voltage is very marked. It is possible to work any bell in full ringing in the most inflammable mixture of illuminating gas and air without igniting the mixture while the shunt path is connected. Ignition occurs the moment that it is disconnected. By having a scraping contact in the box, it can be shown that the same increase of safety is obtained on the signalling wires as at the trembler-contact.

When applied for the purpose of preventing ignition of gas, there is another important point to consider which is not well known. It is only within the last five or six years that the currents which will ignite gas have been determined, and it is only as a result of long and laborious trials that one is able to say by inspection whether or not a certain spark will ignite gas. When the use of a resistance across bell-coils (and not across the gap) was first tried by the author in discussion with his colleague, Mr. W. W. Firth, who had suggested shunting the gap, he was able to say from previous work—of which accounts have been given to the Institute—that from its appearance the nature of the spark was completely changed, and that ignition would not occur. This was soon verified by enclosing the bell in a large explosion box, and the method has never been found to fail. The device does for electric signalling-bells what gauze does for a miner's safety-lamp; so long as it is in normal action, ignition cannot occur.

This arrangement, which was first demonstrated at the Senghenydd inquiry, although it greatly diminishes the wear at the sparking contacts, does not appear to have ever been used on electric bells, although Mr. H. R. Kempe* recently states that the principle is well known to telegraphists. It has the advantage that it can be fitted to any existing bell, so making it incapable of igniting the most inflammable pit gas.

The author ventures to submit the device to the consideration of those concerned with the management of coal mines, as a contribution to the safety of underground working.

A discussion followed the reading of the paper, and was reported in the *Colliery Guardian*, to which we are indebted for the following extracts:—Dr. R. V. Wheeler wrote expressing his admiration of the manner in which Dr. Thornton had presented the theory of the common form of battery bell. He had examined a bell fitted with Dr. Thornton's device to prevent sparking, and could testify to its efficiency. There was, however, a practical disadvantage attaching to the use of any device to prevent sparking which involved a circuit other than the ringing circuit. Should the additional circuit by some mischance become broken, the bell would become unsafe and would continue to ring. For that reason, he favoured any device which, though not theoretically or in practice as efficient as Dr. Thornton's, formed an integral part of the ringing circuit and could not be separated from the bell without destroying it. He hoped that, as a result of the investigation now being made for the Home Office, several methods alternative to those already outlined in his recent report would emerge.

Mr. H. R. Kempe wrote that in regard to the influence of resistance, he thought when Dr. Thornton stated "that resistance in the battery or line or bell windings diminished the igniting power of the spark," the author did not sufficiently define what he meant by "resistance in bell windings." High resistance could be obtained by winding the electromagnet with a great number of convolutions of wire. That, however, whilst giving the bell a high resistance, would also give it a high inductance, which was certainly not desirable unless the electromagnet was shunted, which, at that part of the paper, Dr. Thornton did not seem to suggest. He did not consider the arrangement suggested in fig. 8 of the paper was at all a good one. It introduced three contacts in the place of one, and the amount of current which such a device saved was insignificant, as the proper resistance for the shunt would be ten times that of the bell coils which it shunted. He thought Dr. Thornton should, in speaking of the shunt being of "suitable" resistance, have pointed out that "suitable" included "double winding." Also, it would have been better to have said that the value of the shunt should be about ten times the resistance of the coils that it shunted, rather than to have made a rather indefinite statement that the value might be from 20 to 150 ohms. The value ten times was the one adopted by the Post Office for all local apparatus such as sounders, the object of the shunt being to get rid of sparking at the relay contacts. Such shunts had been in use for the last 30 to 40 years. In regard to the statement that the shunt device had never been used on electric bells, he might mention that the Post Office arranged, some time ago, to fit a number of bells for special purposes with spark shunts (bell coils 100 ohms, shunt 1,000 ohms), and he believed these were being installed. The bells were rather large and were to be worked from relays. The use of bells shunted to prevent gas ignition was novel, and should be made compulsory. "Double winding" of the shunts should be specifically mentioned in the specifications of such bells.

Mr. W. C. Mountain remarked that the experiments they had just seen were very conclusive proof that Dr. Thornton had almost certainly produced a bell which would reduce risks from explosion. A bell built upon Dr. Thornton's idea would cost so very little more than an ordinary bell that he thought what Dr. Thornton had done was of very considerable value. He did not suggest that the use of the improved bell should be compulsory; there were many places in which there was no risk at all. He thought the installation of such a bell should be determined by the conditions.

In a brief reply, Dr. Thornton said Dr. Wheeler had raised the most vital objection—if it were vital—namely, that one should have some arrangement for checking sparks, the failure of which would stop the bell. That would be ideal, of course, but it could not be done without the introduction of auxiliary devices, which were not wanted.

* Electrical Review, 1915, Vol. LXXVI, page 886.

TRADE STATISTICS OF ITALY.

The following statement, showing the imports of electrical and similar goods into Italy during the year 1913, is extracted from the recently issued trade statistics. The figures for 1912 are added for purposes of comparison, and notes of any increases or decreases are given.

	1912. Lire.	1913. Lire.	Inc. or dec. Lire.
Copper, brass or bronze wire more than ½ mm. diameter.—			
From France	1,114,000	908,000	– 206,000
,, Germany	1,176,000	1,003,000	– 173,000
,, Great Britain ...	31,000	7,000	– 24,000
,, United States ...	65,000	—	– 65,000
,, Other countries ...	72,000	49,000	– 23,000
Total	2,458,000	1,967,000	– 491,000
Copper, brass or bronze wire of ½ mm. diameter or less.—			
From Germany	511,000	353,000	– 158,000
,, France	161,000	89,000	– 72,000
,, Other countries ...	10,000	45,000*	+ 35,000
Total	682,000	487,000	– 195,000
Boilers.—			
From France	41,000	23,000	– 18,000
,, Germany	434,000	231,000	– 203,000
,, Great Britain ...	1,865,000	1,077,000	– 788,000
,, Switzerland	55,000	146,000	+ 91,000
,, Other countries ...	276,000	41,000	– 235,000
Total	2,671,000	1,518,000	– 1,153,000
Electrical apparatus.—			
From Germany	3,827,000	3,978,000	+ 151,000
,, Great Britain ...	187,000	145,000	– 42,000
,, Switzerland	269,000	330,000	+ 61,000
,, United States ...	145,000	369,000	+ 224,000
,, Other countries ...	222,000	165,000	– 57,000
Total	4,650,000	4,987,000	+ 337,000
Arc lamps.—			
From Germany	279,000	220,000	– 59,000
,, Austria-Hungary ...	11,000	5,000	– 6,000
,, Great Britain ...	4,000	2,000	– 2,000
,, France	15,000	19,000	+ 4,000
,, United States ...	5,000	1,000	– 4,000
,, Other countries ...	3,000	2,000	– 1,000
Total	317,000	249,000	– 68,000

* Great Britain, 43,000.

	1912. Lire.	1913. Lire.		Inc. or dec. Lire.
Steam engines, stationary, without boilers.—				
From Belgium	—	137,000	+	137,000
,, Germany	623,000	646,000	+	23,000
,, Great Britain ...	1,184,000	802,000	−	382,000
,, Switzerland	16,000	4,000	−	12,000
,, United States ...	357,000	86,000	−	271,000
,, Sweden	87,000	3,000	−	84,000
,, Other countries ...	163,000	77,000	−	86,000
Total	2,430,000	1,755,000	−	675,000
Steam engines, semi-stationary (with boilers), hot-air motors, compressed air, gas, petrol, etc.—				
From France	133,000	150,000	+	17,000
,, Germany	2,250,000	1,401,000	−	849,000
,, Great Britain ...	1,924,000	1,779,000	−	145,000
,, Switzerland	496,000	329,000	−	167,000
,, United States ...	192,000	150,000	−	42,000
,, Other countries ...	287,000	165,000	−	122,000
Total	5,282,000	3,974,000	−	1,308,000
Dynamo-electric machines weighing more than 1,000 kg.—				
From Austria-Hungary ...	590,000	398,000	−	192,000
,, France	163,000	177,000	+	14,000
,, Germany	4,453,000	2,937,000	−	1,516,000
,, Great Britain ...	471,000	428,000	−	43,000
,, Switzerland	159,000	178,000	+	19,000
,, United States ...	60,000	56,000	−	4,000
,, Belgium	133,000	24,000	−	109,000
,, Other countries ...	79,000	94,000	+	15,000
Total	6,108,000	4,292,000	−	1,816,000
Dynamo-electric machines weighing 1,000 kg. or less.—				
From Austria-Hungary ...	786,000	636,000	−	150,000
,, France	123,000	132,000	+	9,000
,, Germany	3,353,000	2,689,000	−	664,000
,, Great Britain ...	311,000	322,000	+	11,000
,, Switzerland	198,000	161,000	−	37,000
,, United States ...	125,000	131,000	+	6,000
,, Other countries ...	95,000	28,000	−	67,000
Total	4,991,000	4,099,000	−	892,000
Electric transformers.—				
From Austria-Hungary ...	557,000	911,000	+	354,000
,, France	21,000	36,000	+	15,000
,, Germany	2,862,000	1,816,000	−	1,046,000
,, Great Britain ...	12,000	33,000	+	21,000
,, Switzerland	266,000	279,000	+	13,000
,, United States ...	72,000	180,000	+	108,000
,, Other countries ...	2,000	1,000	−	1,000
Total	3,792,000	3,256,000	−	536,000
Parts of dynamo-electric machines and of transformers.—				
From France	132,000	168,000	+	36,000
,, Germany	1,158,000	975,000	−	183,000
,, Great Britain ...	138,000	194,000	+	56,000
,, United States ...	115,000	60,000	−	55,000
,, Switzerland	222,000	49,000	−	173,000
,, Other countries ...	110,000	407,000	+	297,000
Total	1,875,000	1,853,000	−	22,000
Electric lamps, incandescent.—				
From Austria-Hungary ...	2,340,000	2,362,000	+	22,000
,, Sweden	40,000	—	−	40,000
,, France	266,000	138,000	−	128,000
,, Germany	5,105,000	5,486,000	+	381,000
,, Great Britain ...	10,000	8,000	−	2,000
,, Switzerland	163,000	141,000	−	22,000
,, Other countries ...	685,000	957,000*	+	272,000
Total	8,609,000	9,092,000	+	483,000
Carbons of all kinds for electro-technical purposes.—				
From Austria-Hungary ...	221,000	133,000	−	88,000
,, Germany	580,000	666,000	+	86,000
,, France	81,000	86,000	+	5,000
,, Switzerland	11,000	41,000	+	30,000
,, United States ...	54,000	50,000	−	4,000
,, Other countries ...	2,000	4,000	+	2,000
Total	949,000	980,000	+	31,000
Accumulators and metal parts.—				
From Germany	64,000	33,000	−	31,000
,, Great Britain ...	1,000	10,000	+	9,000
,, France	77,000	80,000	+	3,000
,, Other countries ...	2,000	8,000	+	6,000
Total	144,000	131,000	−	13,000

* Netherlands, 921,000.

The classes of electrical and allied goods, in which Italy is making most progress as an exporter, are shown in the following comparative figures of her exports (special trade) in 1912 and 1913:—

	1912. Lire.	1913. Lire.		Inc. or dec. Lire.
Dynamo-electric machines, weighing 1,000 kg. or less.—				
To Argentine Republic ...	666,000	730,000	+	64,000
,, France	265,000	332,000	+	67,000
,, Brazil	202,000	201,000	−	1,000
,, Austria-Hungary ...	108,000	69,000	−	39,000
,, Other countries ...	624,000	714,000	+	90,000
Total	1,865,000	2,046,000	+	181,000
Copper, brass or bronze wire more than ½ mm. diameter.—				
To India and Ceylon ...	292,000	426,000	+	134,000
,, Tripoli	99,000	79,000	−	20,000
,, Egypt	20,000	16,000	−	4,000
,, Other countries ...	27,000	40,000	+	13,000
Total	438,000	561,000	+	123,000
Boilers (including multitubular).—				
To Argentine Republic ...	183,000	163,000	−	20,000
,, Tunis	112,000	13,000	−	99,000
,, Tripoli	50,000	28,000	−	22,000
,, Brazil	59,000	40,000	−	19,000
,, Chili	122,000	14,000	−	108,000
,, Other countries ...	160,000	187,000*	+	27,000
Total	686,000	445,000	−	241,000

* Egypt 163,000.

Steam engines, stationary, without boilers.—				
To Argentine Republic ...	730,000	124,000	−	606,000
,, Spain	152,000	109,000	−	43,000
,, Tunis	113,000	5,000	−	108,000
,, Russia	33,000	41,000	+	8,000
,, Portugal	29,000	—	−	29,000
,, Other countries ...	199,000	263,000*	+	64,000
Total	1,256,000	542,000	−	714,000

* Turkey, 50,000.

Steam engines, semi-stationary, with boilers.—				
To Argentine Republic ...	346,000	990,000	+	644,000
,, Tripoli	397,000	312,000	−	85,000
,, Roumania	372,000	167,000	−	205,000
,, Egypt	213,000	792,000	+	579,000
,, France	119,000	59,000	−	60,000
,, Russia	111,000	594,000	+	483,000
,, Other countries ...	518,000	1,844,000*	+	1,326,000
Total	2,076,000	4,758,000	+	2,682,000

* Great Britain, 328,000; Spain, 349,000; Turkey, 234,000.

N.B.—25 lire = £1.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PANAMA.—The Government of Panama has recently imposed certain new taxes on commercial documents as follows:

Bills of exchange: A 10 cents stamp for every 100 dollars or fraction thereof must be affixed to bills of exchange or drafts drawn in national territory or drawn in foreign territory to be collected in Panama.

Bills of lading for merchandise imported into the country must bear on the first two copies a 50 cents stamp, and those authorised and issued in the Republic for national or foreign ports 25 cents for each of the first two copies.

Accounts, invoices, receipts and, in general, every private document acknowledging debt or the cancellation thereof, must bear stamps as follows: Up to 5 dols., 1 cent; from 5 dols. up to 10 dols., 2 cents; from 10 dols. to 25 dols., 5 cents; from 25 dols. to 50 dols., 10 cents; from 50 dols. to 100 dols., 20 cents; from 100 dols to 200 dols., 30 cents; over 200 dols., 50 cents.

SOUTH AFRICA.—A recent Act of the South African Government raises the import duty on "goods not separately mentioned in the tariff" (under which heading various electrical and similar goods are dutiable) from 15 per cent. to 20 per cent. in the case of goods of foreign origin, and from 12 per cent. to 17 per cent. in the case of British goods.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

11,161. "Method of generating high-frequency electric current." T. F. WALL. August 3rd.

11,168. "Manufacture of electrical conductor or wire retaining bands and apparatus therefor." E. FEWKES. August 3rd.

11,172. "Means for suspending and adjusting electric overhead conductors." BRITISH INSULATED & HELSBY CABLES, LTD., and J. W. ASTLEY. August 3rd.

11,201. "Mounting of switches and other electrical apparatus in wall boxes." C. H. BURT. August 3rd.

11,214. "Electric light fittings, such as electroliers, wall brackets, sconces, and the like." J. A. CHELL. August 3rd.

11,218. "Arc lamp electrodes." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States). August 3rd.

11,224. "Magnetos applicable for the lighting of vehicles." J. BETHENOD. August 3rd. (Convention date, July 27th, 1914, Belgium.) (Complete.)

11,259. "Signalling device for printing telegraphs." D. MURRAY. August 4th.

11,260. "Method of synchronism for printing telegraphs." D. MURRAY. August 4th.

11,262. "Coating metals." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States). August 4th.

11,263. "Electrical windings." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States). August 4th.

11,264. "Electrically-operated tools." FRANKFURTER MASCHINENBAU AKT. GES. VORM. POKORNY & WITTEKIND. August 4th. (Convention date, August 14th, 1914, Germany.) (Complete.)

11,314. "Electrolytic magnifiers." W. JUDD, A. FRASER & EASTERN TELEGRAPH Co., LTD. August 5th. (Complete.)

11,321. "Starting and synchronising of dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD., & F. P. WHITAKER. August 5th.

11,322. "Cord grips for electrical purposes." R. G. STRIPP. August 5th.

11,332. "Incandescent electric lamps (or) and the method of manufacturing same, especially applicable to the manufacture of so-called half-watt lamps or gas-filled glow lamps." C. O. BASTIAN. August 5th.

11,335. "Electrolytic recovery of zinc from ores and other zinc-bearing materials." U. C. TAINTON. August 5th. (Complete.)

11,336. "Electrolytic recovery of metals from their solutions, and apparatus therefor." U. C. TAINTON. August 5th. (Complete.)

11,374. "Elastic fluid turbines." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States). August 6th.

11,375. "Means for the production of sound by electromagnetically-operated diaphragms." E. A. GRAHAM. August 6th. (Complete.)

11,410. "Trolley wheels for electric tramcars and other vehicles." F. J. NEACHELL & L. LOUKES. August 7th.

11,415. "Telephone transmitters and the like." A. MARR. August 7th.

PUBLISHED SPECIFICATIONS.

1913.

23,449. ELECTRIC PROTECTIVE SYSTEMS. E. G. Waters. October 16th. (April 16th, 1914.)

28,369. SPARK-GAP APPARATUS FOR PRODUCING ELECTRIC OSCILLATIONS. Dr. E. F. Huth Ges. December 9th. (December 27th, 1912.)

28,898. ARRANGEMENTS FOR AUTOMATICALLY REGULATING THE VOLTAGE OF DYNAMO MACHINES. Fried. Krupp Akt. Ges. December 15th. (January 11th, 1913.)

29,227. AUXILIARY MACHINERY FOR STEAM-CONDENSING PLANTS. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.). December 18th.

29,341. ELECTRIC TUMBLER SWITCHES. Geb. Jaeger. December 19th. (November 27th, 1913.)

29,344. PENDANT SWITCHES FOR ELECTRIC CIRCUITS. Geb. Jaeger. December 19th. (November 27th, 1913.)

29,426. CIRCUIT ARRANGEMENTS FOR AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. December 20th. (December 20th, 1912. Patent of addition not granted.)

29,609. MEANS FOR EFFECTING THE GAS-TIGHT INTRODUCTION OF ELECTRODES INTO METAL VAPOUR APPARATUS. A. Scherbius. December 23rd. (December 23rd, 1912.)

29,645. AUTOMATIC PREPAYMENT TELEPHONE APPARATUS. Ges. fur Elektrische Industrie. December 23rd. (November 19th, 1913.)

29,689. ELECTRICALLY-ACTUATED MECHANISM FOR CONTROLLING FROM A DISTANCE RAILWAY TRAINS AND OTHER APPARATUS. C. Wirth. December 24th.

29,883. AUTOMATIC SELECTING DEVICES FOR TELEPHONE SYSTEMS. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). December 29th.

29,981. ELECTRIC INCANDESCENT LAMPS. H. A. Gill (Wolfram Lampen Akt. Ges.). December 30th.

30,045. MEANS FOR PULLING OFF OVERHEAD ELECTRICAL CONDUCTORS OR CONTACT WIRES. Siemens Schuckertwerke Ges. December 31st. (December 31st, 1912.)

1914.

134. ELECTRIC SAFETY LAMP FOR MINES. W. Kraushaar. January 2nd. (January 7th, 1913.)

10,193. APPARATUS FOR THE PRODUCTION OF ALKALI METALS BY THE MOLTEN ELECTROLYSIS OF ALKALI COMPOUNDS. Deutsche Gold & Silber-Scheide-Ansalt vorm Rössler. April 24th. (April 26th, 1913.)

10,478. CONNECTING DEVICE FOR THE LEADS FROM PORTABLE SECONDARY BATTERIES. Robert Bosch (firm of). April 28th. (March 24th, 1914. Addition to 7,686/14.)

11,052. TELEPHONE INSTRUMENTS. Siemens Bros. & Co. and F. Baker. May 5th.

11,102. METHODS OF PRODUCING ELECTRIC OSCILLATIONS. E. von Lepel. May 5th.

11,112. MANUFACTURE OF STRATIFIED FIBROUS MATERIALS, ESPECIALLY FOR CHEMICAL AND ELECTRIC INSULATING PURPOSES. Meirowsky & Co. and M. Meirowsky. May 5th.

11,212. CIRCUIT ARRANGEMENTS FOR TELEPHONE EXCHANGES. Siemens Bros. and Co., Ltd. (Siemens & Halske Akt. Ges.). May 6th. (Addition to 27,458/09 and 18,356/12.)

11,340. MEANS FOR PREVENTING TOO RAPID CHANGES OF SPEED OF MACHINERY. Siemens Schuckertwerke Ges. May 7th. (May 7th, 1913.)

11,408. APPLIANCE FOR ELECTRICAL JACQUARD OR CARD-PUNCHING OR LIKE MACHINES. Osterreichische Siemens Schuckertwerke & Regal Patente Ges. May 8th. (May 10th, 1913.)

11,410. ELECTRICAL CONTACT DEVICES FOR READING ELECTRICAL PATTERNS OR THE LIKE. Osterreichische Siemens Schuckertwerke & Regal Patente Ges. May 8th. (May 10th, 1913.)

11,561. APPARATUS FOR CONVERTING ALTERNATING-CURRENT INTO PULSATING DIRECT-CURRENT. W. Otto. May 11th. (May 24th, 1913.)

14,513. METHOD OF AND APPARATUS FOR USE IN AND IN CONNECTION WITH ELECTROLYTIC AND METAL-CLEANING PROCESSES. A. E. Battle. June 17th.

14,514. RECOVERY AND ELECTRO-DEPOSITION OF TIN. A. E. Battle. June 17th. (Cognate application, 15,602/14.)

14,798. TELEPHONIC TRANSMITTERS AND RECEIVERS. International Electric Co., Ltd. (Akt. Ges. Mix & Genest). June 19th.

14,866. APPARATUS FOR CONTROLLING MOTORS FROM A DISTANCE. A Mond (Maschinenfabrik Oerlikon). June 20th.

15,758. HIGH-TENSION ELECTRIC IGNITION FOR INTERNAL-COMBUSTION ENGINES. A. R. Bellamy. July 1st. (December 30th, 1914.)

16,696. RAILWAY BLOCK TELEGRAPH SIGNALLING APPARATUS. O. W. Brain and C. A. Hodgson. July 13th.

16,776. APPARATUS FOR PRODUCING GALVANIC OR ELECTROLYTIC DEPOSITS. P. L. Ozil. July 14th. (July 15th, 1913.)

17,131. METHODS FOR PRODUCING DEVICES CONSISTING OF SUBSTANCES LIABLE TO CHANGES IN THEIR OHMIC RESISTANCE UNDER THE ACTION OF LIGHT, ESPECIALLY ELECTRIC LIGHT SENSITIVE PREPARATIONS AND THE LIKE. S. Kahan (Yapolsky). July 20th.

17,317. ELECTRICAL MEASURING INSTRUMENTS. British Thomson-Houston Co. (General Electric Co., U.S.A.). July 21st.

17,331. APPARATUS FOR GENERATING HIGH-FREQUENCY ELECTRIC CURRENTS. A. Heyland. July 21st. (August 18th, 1913.)

17,332. FILAMENT FOR INCANDESCENT ELECTRIC LAMPS. W. G. Hughes. July 21st.

17,335. TROLLEY WHEELS OR COLLECTORS FOR ELECTRICITY. H. C. Adam and J. C. Adam. July 21st.

17,391. ELECTRICAL HEATING APPARATUS. G. H. Collins & H. F. Collins. July 22nd.

17,424. PROTECTING DEVICE FOR THE ACCESSORIES OF ELECTRICAL METERS AND MEASURING INSTRUMENTS. W. E. Evans (Allgemeine Elektricitäts Ges.). July 22nd.

17,425. FURNACE ELECTRODE. W. E. Evans (Elektrochemische Werke Ges.). July 22nd.

17,426. METHOD OF AND APPARATUS FOR PRODUCING FLOWS IN THE MOLTEN MASSES OF ELECTRICAL FURNACES. W. E. Evans (Electrochemische Werke Ges.). July 22nd.

17,437. JUNCTIONS OR CONNECTIONS FOR ELECTRICAL CONDUITS AND OTHER PIPES. H. H. Longbottom & T. Farrar. July 23rd.

17,446. TELEPHONE SYSTEMS. M. S. Conner & R. E. Robinson. July 23rd.

17,611. ELECTRIC FIRE AND TEMPERATURE ALARMS. N. Bendixen. July 25th.

17,894. ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. & A. C. Hastings. July 28th.

18,281. VENTILATION OF DYNAMO-ELECTRIC MACHINES. G. A. Juhlin. August 7th.

18,738. ELECTRICALLY-ACTUATED TOOLS. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co.). August 17th.

18,842. VALVE-OPERATING MECHANISM FOR ELASTIC FLUID TURBINES. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). August 19th.

19,886. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. T. Crosbee and Sons, Ltd., & D. McGregor. September 17th.

20,133. ELECTRICAL CONTACTS. Igranic Electric Co. (Cutler Hammer Manufacturing Co.). September 24th.

20,871. ELECTRIC COUPLING MECHANISM FOR USE ON RAILWAY VEHICLES. R. Belfield (Doyle & Hedley). October 12th.

21,190. ELECTRO-OSMOTIC IMPREGNATING PROCESS. Ges. fur Elektro-Osmose October 19th. (January 7th, 1914. Addition to 19,849/14.)

21,727. ELECTROLYTIC APPARATUS. G. Plancq. October 29th.

21,793. AUTOMATIC SELECTING DEVICES FOR TELEPHONE SYSTEMS. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). October 30th. (Addition to and divided application on 29,883/13, dated July 16th, 1914.)

21,921. LOUD-SPEAKING TELEPHONE APPARATUS. H. J. C. Forrester (International Callophone Corporation). November 3rd.

22,914. OPERATION OF POLYPHASE ELECTRIC MOTORS IN CONNECTION WITH SINGLE-PHASE ALTERNATING CURRENTS. B. G. Lamme. November 23rd. (December 26th, 1913.)

22,989. CONTROLLING ARRANGEMENTS FOR ELECTRIC MOTORS. C. B. Burdon (Siemens Schuckertwerke Ges.). November 24th.

1915.

121. MEANS FOR OBTAINING A HIGH-STARTING TORQUE ON A CONTINUOUS-CURRENT MOTOR WITH A RELATIVELY SMALL STARTING CURRENT. A. J. Leigh and H. J. Osborn. January 4th.

275. ELECTRIC WAVE AMPLIFYING APPARATUS. Western Electric Co. (Western Electric Co., U.S.A.). January 7th.

831. STRAY-WAVE PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. Siemens-Schuckertwerke Ges. January 19th. (January 20th, 1914. Addition to 17,532/13.)

1,007. MEANS FOR OBTAINING PERIODICALLY-INTERRUPTED CURRENTS OF ELECTRICITY. W. H. Grinsted. January 21st.

3,715. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. H. W. van Raden. March 9th.

4,761. ELECTRICAL CABLES, SPECIALLY APPLICABLE TO CABLES HAVING A PROTECTIVE SHEATHING OF RUBBER. British Insulated and Helsby Cables, Ltd., and J. Brotherton. March 27th.

5,696. AUTOMATIC SWITCHING APPARATUS FOR ELECTRICALLY-ILLUMINATED SIGNS AND THE LIKE. E. Savoye. April 15th. (April 30th, 1914. Addition to 823/15.)

8,561. LOUD-SPEAKING TELEPHONE SYSTEMS AND APPARATUS. H. J. C. Forrester (International Callophone Corporation). (Divided application on 21,921/14, November 3rd.) June 9th.

U.S.A. Electrical Exports.—The *Electrical World* states that the figures of electrical export trade for May do not sustain, as they might be expected to do, the figures of April, which showed a gain of about $250,000 over the previous year, the totals being respectively $1,741,551 and $2,055,375; the May figures are $1,802,209, as compared with $2,040,720 a year ago. The figures for the 11 months of the fiscal year, inclusive of May, are more "revelatory" of the fact that up to the present the United States has not been able to seize the opportunity of supplying neutral markets, deprived by the war of apparatus and appliances from Europe; or it may be that the various dams of blockade, submarine attack, high rates of freight and insurance do not hold up European exports. The total electrical exports for the 11 months of 1914-15 were only $17,724,676, as compared with $23,610,407 in 1913-14 and $24,458,084 in 1912-13.